

Increasing Airpower's Effectiveness: Applying the U.S. Army's Operational Design Methodology to Airpower in Warfare

**A Monograph
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Abstract

Increasing Airpower's Effectiveness: Applying the U.S. Army's Operational Design Methodology to Airpower in Warfare by Major Shawn A. Serfass, USAF, 60 pages.

This monograph examines whether or not the current U.S. Army Operational Design methodology could increase the effectiveness of airpower. Analysis of existing design literature provides a common understanding of the U.S. Army's design methodology for the application to two historical case studies. The studies selected for analysis resulted from the similarity of key components. Both involved operations in North Vietnam where major combatants shared the common political goal of trying to extricate themselves from the conflict. Although in each study major combatants could not have used the current conception of operational design, leveraging the framework provided by the U.S. Army reveals some interesting conclusions. The first study analyzed Operation CASTOR and the subsequent battle for Dien Bien Phu. CASTOR demonstrates that airpower's effectiveness could have increased had the French used the U.S. Army's Operational Design methodology. The lack of systems thinking, reflective thinking, environmental framing and the inability to reframe all reduced the effectiveness of airpower and ultimately led to CASTOR's failure. The second study, Operation LINEBACKER II, suggests that using the U.S. Army's Operational Design methodology has a positive impact on airpower. The presence of systems thinking and reflective thinking by Strategic Air Command planners, the development of a mature environmental frame, the establishment of reframing criteria and the ability to reframe when required all increased airpower's effectiveness. This monograph demonstrates the value of operational design to air campaign planners and the potential for inclusion into existing Air Force doctrine.

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Introduction

As early as the nineteenth century one of warfare's greatest theorists, Carl Von Clausewitz, recognized that war is complex. Clausewitz understood that because humans are involved in waging war, and humans are complex entities, war is thus bound to be a complex phenomenon.¹ Alan Beyerchen examined this idea further and concluded in his article *Clausewitz, Nonlinearity, and the Unpredictability of War* that, "chance and complexity dominate simplicity in the real world. Thus no two wars are ever the same."² Neil F. Johnson, a physics professor at the University of Miami, wrote that "modern warfare seems to exhibit all the characteristics of Complex Systems."³ Combatants learn and evolve in a manner reminiscent to what Robert Axelrod would call a complex adaptive system. According to Axelrod, a system is complex and adaptive when it "contains agents or populations that seek to adapt."⁴ United States Air Force (USAF) Doctrine embraces these ideas, acknowledging that "war is a contest of wills, a collision of living forces that creatively adapt to stimuli in ways scientists today describe in terms

¹ Carl Von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret [Princeton: Princeton University Press, 1976], 86. Clausewitz writes "the art of war deals with living and with moral forces. Consequently, it cannot attain the absolute, or certainty; it must always leave a margin for uncertainty, in the greatest things as much as in the smallest."

² Alan Beyerchen, "Clausewitz, Nonlinearity, and the Unpredictability of War," *International Security* 17, no. 3 [Winter 1992]: 90.

³ Neil F. Johnson, "Complexity in Human Conflict," in *Managing Complexity: Insights, Concepts, and Applications*, ed. Dirk Helbing [Berlin: Springer Press, 2008], 305. Johnson says that the six characteristics are: (1) There is feedback, both at the microscopic and macroscopic scale, yielding a system with memory. (2) The time-series of events is non-stationary, meaning that the character of the distribution may change over time. (3) There are many types of 'particle', according to the various armed actors, and they interact in possibly time-dependent ways. A conflict's evolution is then driven by this ecology of agents. (4) The agents can adapt their behavior and decision based on past outcomes. (5) The observed conflict constitutes a single realization of the systems possible trajectories. (6) The system is open, with this coupling to the environment making hard to distinguish between exogenous and endogenous effects.

⁴ Robert Axelrod and Michael D. Cohen, *Harnessing Complexity* [New York: Basic Books, 2000], 7. Axelrod and Cohen write that an agent is something that has the ability to interact with its environment, including other agents. An agent can respond to what happens around it and can do things more or less purposefully. They also note that a system is complex when there are strong interactions among its elements, so that current events heavily influence the probabilities of many kinds of later events.

of chaos, emergence, and complexity theories.”⁵ It is in this complex environment that airpower must effectively operate. One way to manage this complexity is through the U.S. Army’s Operational Design methodology. The central question this monograph seeks to answer is whether design can increase the operational effectiveness of airpower in warfare.

The U.S. Army’s Operational Design methodology gives airpower practitioners another tool to creatively manage the complexity of warfare and increase the effectiveness of airpower. Operational design accomplishes this by enabling a deep understanding of the tensions existing between various agents, their interconnectedness, and their potential. Design also increases airpower’s effectiveness through the development of mechanisms to ensure the understanding of an environment is sound, and if not, how to reframe the proposed solution. A second, but no less important consequence is that by understanding and applying design, Airmen are better able to communicate with U.S. Army planners who also utilize operational design, furthering a joint understanding of how the services plan and fight.

Colin S. Gray noted in the winter 2008 *Strategic Studies Quarterly* that “airpower is militarily relevant to every conflict, be it largely irregular in character or be it conventional.”⁶ Because airpower is integral to all warfare and warfare by its very nature is complex, the USAF subscribes to Effects Based Operations (EBO) as a way of managing this complexity. The USAF believes that applying operational art to airpower “requires an effects-based methodology that uses the full range of capabilities available and considers innovative ways to employ them.”⁷

⁵ Headquarters Department of the Air Force, Air Force Doctrine Document 2: *Operations and Organization*, [Washington D.C: Department of the Air Force, 2007], 17. Air Force Doctrine Document 1, Basic Air Force Doctrine, warns that “if we ignore the reality that adaptive, thinking adversaries will seek asymmetric strategies, anti-access capabilities, and favorable arenas within which to influence and engage us, we risk catastrophic surprise.”

⁶ Colin S. Gray, “Understanding Airpower: Bonfire of the Fallacies,” *Strategic Studies Quarterly* [Winter 2008]: 60.

⁷ Headquarters Department of the Air Force, Air Force Doctrine Document 2-3: *Irregular Warfare*, [Washington D.C: Department of the Air Force, 2007], 57.

However, the U.S. Army's Operational Design methodology is an alternative to EBO that also manages complexity and shows great potential for increasing airpower's effectiveness in warfare. Recent discourse emerging from U.S. Joint Forces Command (JFCOM) supports this assertion. According General James N. Mattis, the commander of JFCOM, "the other services as well as the joint community are beginning to appreciate that the Army has achieved positive results with its initiative, and I believe the Army has demonstrated the value of this new approach to operational design."⁸ Applying airpower in warfare is deadly business and effectiveness is critical. If any doubt remains as to the need to explore additional methods that increase the effectiveness of airpower in warfare one need only look at recent media headlines. In July 2009, the *Washington Post* quoted the senior U.S. military commander in Afghanistan, General Stanley McChrystal, as saying "air power contains the seeds of our own destruction if we do not use it responsibly."⁹

Methodology

This monograph will demonstrate how the U.S. Army's Operational Design concept methodology increases the effectiveness of airpower in warfare. The monograph will first establish a common understanding of what operational design is, drawing primarily from the literature instructed at the U.S. Army's School of Advanced Military Studies (SAMS). Emphasis is placed on the design elements most relevant to the application of airpower in warfare. The next step will analyze two historical case studies in order to demonstrate how applying the Army's Operational Design concept can increase the effectiveness of airpower. The case studies were selected due to several common factors. First, both operations occurred in North Vietnam. Both

⁸ James N. Mattis, Memorandum for U.S. Joint Forces Command: Vision for a Joint Approach to Operational Design [Norfolk: USJFCOM, 2009], 1.

⁹ Jason Motiagh, "U.S. to limit air power in Afghanistan," *The Washington Times*, June 24, 2009, under "World News," <http://www.washingtontimes.com/news/2009/jun/24/us-to-limit-air-power-in-afghanistan/> [accessed February 28, 2010].

cases involved a western force combating a foe that adhered to a “Maoist version of the protracted-popular-war strategy”¹⁰ which entered the strategic offensive. Finally, the political objectives of western forces were the same. Both the French and Americans desired to extricate themselves from an insurgency under the best possible circumstances.

Operation CASTOR and the subsequent battle of Dien Bien Phu demonstrate how the absence of systems and reflective thinking, the lack of a mature environmental frame, and the failure to reframe when necessary marginalized the effectiveness of airpower. The absence of systems thinking rendered ineffective the French Air Force’s interdiction and support plan. Lack of reflective thinking committed the French Air Force to a plan based on faulty assumptions. The lack of operational design during French planning and execution doomed the garrison, ultimately leading to the defeat of the French during the First Indochina War.

The second case study examines Operation LINEBACKER II and illustrates how design increased the effectiveness of airpower. Strategic Air Command (SAC) planners used systems and reflective thinking to create an effective bombing strategy against North Vietnam’s logistical and air defense system. The presence of a mature environmental frame ensured planners understood the key tensions within the operational environment, exploiting those tensions to their benefit as witnessed by the destruction of targets close to the Chinese border. The presence of reframing criteria resulted in a flexible air campaign that increased airpower’s effectiveness, ultimately allowing the United States to withdraw from Vietnam under conditions more favorable to U.S. policy makers.

Finally, one limitation with the aforementioned case studies requires an explanation. Although the selected studies are old, this is driven in large part by the availability of unclassified information and the desire to ensure the widest accessibility to a variety of audiences. Operations

¹⁰ Bard E. O’Neill, *Insurgency and Terrorism: From Revolution to Apocalypse*, 2nd ed. [Washington D.C: Potomac Books Inc., 2005], 50.

CASTOR and LINEBACKER II are simply more accessible case studies than current operations in Afghanistan and Iraq.

What Is Operational Design?

In order to demonstrate how operational design increases the effectiveness of airpower in warfare, it is necessary to first describe the U.S. Army's approach to design. Operational design is not a linear, scripted planning process like the Military Decision Making Process, Joint Air Operations Process (JAOP), or the Joint Operations Planning Process (JOPP). Rather, operational design is more a way of thinking than a linear process.

Colonel Stefan Banach, the Director of SAMS, and Dr. Alex Ryan describe operational design as “a way of thinking more than it is a theory, process, or product.”¹¹ Lieutenant General William Caldwell, the former Commandant of the US Army Command and General Staff College, supports this description of design. He states “design is not a process, but a set of ‘thinking tools’ that complement and reinforce our operations process with a rational, logical approach to an increasingly complex and dynamic operational environment.”¹² In other words, “design is a [way] to think critically and creatively” and “aims to overcome the deficiencies of industrial-age tools for operational art and planning.”¹³ Jamshid Gharajedaghi noted that, “design is the potential means of controlling, influencing, and appreciating the parameters affecting [a]

¹¹ Stefan J. Banach and Alex Ryan, “The Art of Design: A Design Methodology,” *Military Review* [March-April 2009]: 105.

¹² Jack D. Kem, *Design: Tools of the Trade*, [Fort Leavenworth, KS: U.S Army Command and General Staff College Publishing, 2009], iii.

¹³ Christof Shaefer, “Design: Extending Military Relevance” *Military Review* (September-October 2009): 30. Shaefer goes on to write that design as a methodology “enables the blend of military art and science in a creative way in order to harvest the corporate genius of an organization in an effort to manage and solve the complex problems that confront today’s military practitioners.”

system's existence.”¹⁴ Dr. Shimon Naveh and his colleagues wrote in *The Structure of an Operational Revolution*, that “in a narrow sense, one can argue that design is a practice of constructing both a systemic frame of understanding about the world and a systemic frame of intervention that operationally pursues the potential logic set by the operations frame.”¹⁵ They later identify that “the purpose of operational design is to rationalize complex human emergences, by developing system constructs indicating potential for strategic transformation, through the application of operational interventions.”¹⁶ In his book, *How Designers Think*, Bryan Lawson argues that design is a thinking skill and that many forms of design “deal with both precise and vague ideas, call for systematic and chaotic thinking, [and] need both imaginative thought and mechanical calculation.”¹⁷ According to Lawson, the elements “commonly found in successful design” are “‘formulating’, ‘moving’, ‘representing’, ‘evaluating’, and ‘reflecting’”¹⁸

While all of these characterizations are valuable, this monograph will subscribe to the U.S. Army's Field Manual (FM) 5-0 *The Operations Process* description that states “design is a methodology for applying critical and creative thinking to understand, visualize, and describe ill-structured problems and develop approaches to solve them.”¹⁹ The Army's design methodology is based on a foundation of systems thinking, reflective thinking, rigorous discourse and iteration that enables practitioners to obtain a holistic understanding of a problematic situation. Once understanding is achieved, these foundations enable the framing aspect of design that provides

¹⁴ Jamshid Gharajedaghi, *Systems Thinking, Managing Chaos and Complexity: A Platform for Designing Business Architecture*, 2nd ed. [Burlington: Elsevier Publishing, 2006], 317.

¹⁵ Shimon Naveh, Jim Schneider, and Timothy Challans, *The Structure of Operational Revolution: A Prolegomena* [Leavenworth: Booz Allen Hamilton Inc., 2009], 70.

¹⁶ Naveh, Schneider, and Challans, *The Structure of Operational Revolution*, 95.

¹⁷ Bryan Lawson, *How Designers Think: The Design Process Demystified*, 4th ed. [Oxford: Architectural Press, 2006], 4.

¹⁸ Lawson, *How Designers Think*, 291.

¹⁹ Headquarters Department of the Army, Field Manual 5-0: *The Operations Process* [Washington D.C: Department of the Army, 2010], 3-1.

further contextual understanding and synthesis in the development of a broad, general solution to a problem. The U.S. Army's Operational Design construct was selected over other previously described design methods because it holds great potential for increasing the operational effectiveness of airpower. Effective use of "design improves the ability to adapt",²⁰ and that the FM 5-0 description of design helps planners to "understand that each situation requires a solution tailored to the context of the problem. Design provides an approach for leading innovative, adaptive efforts from which to effectively act on and efficiently solve a complex, ill-structured problem."²¹ Design also increases operational effectiveness through "economy of effort, greater coherence across units and between successive operations, better integration and coordination among the instruments of national power, fewer unintended consequences and effective adaptation once the situation changes."²²

Operational Design Foundations

It is important to spend time describing the foundations of operational design. However, this monograph will primarily focus on systems and reflective thinking because their presence or absence altered the outcome of both case studies. For example, the presence of systems thinking amongst the planners in Operation LINEBACKER II influenced the interdiction aspect of the bombing campaign. The lack of this type of thinking manifested itself in the French Air Forces inability to reduce the combat power of Viet Minh forces at Dien Bien Phu. Reflective thinking enabled U.S. planners to critically analyze many of the assumptions and foundations on which LINEBACKER II was predicated. This lack of reflection led French planners to apply a faulty

²⁰ Headquarters Department of the Army, Field Manual 5-0: *The Operations Process*, 3-6.

²¹ Headquarters Department of the Army, Field Manual 5-0: *The Operations Process*, 3-7.

²² Ibid.

model based upon previous experience without the appropriate context, further reducing the effectiveness of French airpower.

To begin with systems thinking, there is no single systems approach that is the foundation of operational design; rather it is systemic *thinking* that is at the heart of the Army's design methodology. Systems thinking tries "to reason why and how things work based on the premise that practically any situation or problem can be thought of as a system of interdependent elements."²³ This is because "systems thinking is the art of simplifying complexity. It is about seeing through chaos, managing interdependency and understanding choice."²⁴

Another way of demonstrating the kind of systems thinking that is used to power operational design is found in Checkland and Poulter's description of Soft Systems Methodology (SSM). As Gharajedaghi stated earlier, systems thinking helps make sense of complexity, and "SSM focuses on the process of engaging with that complexity."²⁵ SSM "is an action oriented process of inquiry into problematical situations in the everyday world; users learn their way from finding out about the situation to defining/taking action to improve it. The learning emerges via an organized process in which the real situation is explored using as intellectual devices . . . models of purposeful activity."²⁶ The models often take the form of networks or system diagrams. This makes sense since SSM is "a process based on a particular body of ideas, namely systems

²³ John F. Schmitt, "A systemic Concept of Operational Design" [master's thesis, Marine Corps Warfighting Laboratory, 2007], 23.

²⁴ Gharajedaghi, *Systems Thinking*, 315. Jamshid Gharajedaghi's four foundations of systems thinking provide an excellent description of the type of thinking required of design practitioners. On page 107 he states that "effective systems methodology lies at the interaction of four foundations of systems thinking."²⁴ They are 1) "holistic thinking (iteration of structure, function and process)" 2) "operational thinking (dynamics of multi-loop feedback systems; chaos and complexity)," 3) "self-organization, movement toward a predefined order (socio-cultural model)," and 4) "interactive design (redesigning the future and inventing ways to bring it about)."

²⁵ Peter Checkland and John Poulter, *Learning for Action: A Short Definitive Account of Soft Systems Methodology and its use for Practitioners, Teachers and Students* [West Sussex: John Wiley & Sons Ltd, 2006], 63.

²⁶ Checkland and Poulter, *Learning for Action*, 22.

ideas.”²⁷ As with Gharajedaghi’s four foundations, SSM gives practitioners a way to think about the complex problems they are facing and continue with the operational design methodology.

The next foundation of operational design is the concept of reflection or reflective thinking. Donald Schön is a champion of the idea that reflective thinking is critical when applying operational design to a complex adaptive system. He states “at the base, designing is, in its own way, a process of reflection-in-action.”²⁸ Schön understands successfully applying design requires a holistic, iterative approach of which reflection-on-action and reflection-in-action are the key enablers. As practitioners “we may reflect on action, thinking back on what we have done in order to discover how knowing-in-action may have contributed to an unexpected outcome. We may do so after the fact, in tranquility, or we may pause in the midst of action.”²⁹ This kind of thinking enables the iterative, holistic nature of operational design. Colonel Stephan Banach and Dr. Alex Ryan concur, stating that reflective thinking allows practitioners to “improve both their knowledge of their own ability and their capacity to regulate the cognitive focus of themselves and their team.”³⁰ Planners will move through the various aspects of the design methodology simultaneously and reflective thinking helps them “to consider second and third order effects of action; to introduce alternative perspectives that may challenge the established relationships and mental models of [a] situation; and to help create the narrative that explains the systemic logic of the operational environment.”³¹ Jamshid Gharajedaghi offers another perspective on reflection.

²⁷ Checkland and Poulter, *Learning for Action*, 4.

²⁸ Donald A. Schön, *Educating The Reflective Practitioner* [San Francisco: Jossey-Bass Publishing, 1987], 115. Schön later states on page 26 that design practitioners “may reflect in the midst of action without interrupting it. In an action-present-a period of time, variable with the context, during which we can still make a difference to the situation at hand-our thinking serves to reshape what we are doing while we are doing it.”

²⁹ Schön, *Educating The Reflective Practitioner*, 26.

³⁰ Stefan J. Banach and Alex Ryan, “The Art of Design: A Design Methodology,” *Military Review* [March-April 2009]: 108

³¹ Ibid.

He states, “learning results from being surprised: detecting a mismatch between what was expected to happen and what actually did happen. If one understands why the mismatch occurred (diagnosis) and is able to do things in a way that avoids a mismatch in the future (prescription) one has learned.”³² Therefore, reflective thinking is the key component that makes detecting a mismatch possible and learning happen. Reflective thinking also prevents passive adaption during the application of design. “Passive adaption to a deteriorating environment is a road to disaster . . . by the time an organization recognizes the severity of the problem, it may already have lost most of its strength and be unable to do anything about it.”³³ In order to prevent passive adaption and comprehend the impact of friendly actions, reflective thinking is necessary to learn. Learning in turn enables the application of operational design.

The remaining two aspects of operational design’s foundations, discourse and iteration, are not specifically examined in the upcoming case studies. In the Army’s operational design methodology, discourse helps the commander and design team obtain a common shared understanding as to the nature of a problematic situation. Discourse is also a generator of creativity. Peter Senge categorizes discourse as a form of dialogue where “there is a free and creative exploration of complex and subtle issues, a deep ‘listening’ to one another and suspending of one’s own views.”³⁴ Discourse also helps a design team agree on “how reality is to be interpreted and expressed.”³⁵ Iteration is the process of continuously moving through the various foundations and framing activities of design in a continuing attempt to improve

³² Gharajedaghi, *Systems Thinking*, 75. Schön agrees on page 28 of his book *Educating the Reflective Practitioner* that “surprise leads to reflection within an action-present.”

³³ Gharajedaghi, *Systems Thinking*, 55. Passive adaption is what Gharajedaghi refers to as “Pan Am Syndrome.” It is when an organization bleeds “to death by adapting to an imperceptible gradual change, always doing too little too late.”

³⁴ Peter M. Senge, *The Fifth Discipline: The Art and Practice of the Learning Organization* [New York: Doubleday Publishing, 1990], 220.

³⁵ Antoine Bousquet, *The Scientific Way of Warfare: Order and Chaos on the Battlefields of Modernity* [New York: Columbia University Press, 2009], 14.

contextual understanding and synthesis. Iteration is important in managing the delay between decision and action and “helps the commander to overcome this effect.”³⁶ Discourse and iteration permeate all aspects of operational design.

The presence or absence of these foundations influences the effectiveness of airpower by enabling the understanding needed by planners to develop a contextually appropriate solution to a problematic situation. As both case studies will demonstrate, the foundations inform the framing activities of operational design, enabling the best concept for the effective use of airpower. A practitioner of operational design will use these foundations to examine a complex adaptive system in its current state, determine what the desired state of the complex system should be, and identify the tensions between the two. From the analysis of these tensions, various mechanisms are developed to move the system from one state to another.

In Operation CASTOR, French Air Force planners did not develop an environmental frame due to their failure to appreciate the tensions existing between the cultural and political aspects of the operational environment. They also did not establish reframing criteria and thus missed key opportunities to adapt when it was necessary. This reduced the effectiveness of airpower in the subsequent battle for Dien Bien Phu. The planners for Operation LINEBACKER II made no such mistakes. Both political and SAC leadership understood the tensions within the environment and used them in a manner which increased the effectiveness of airpower. U.S. planners also possessed effective reframing criteria and used it to reframe in the wake of events on night three of the air campaign. The presence of a mature environmental frame and the willingness to reframe increased the effectiveness of airpower during LINEBACKER II.

For these reasons it is important to describe the various framing activities of operational design. During the process, practitioners use a series of “frames” informed by the foundations

³⁶ Headquarters Department of the Army, Field Manual 5-0: *The Operations Process*, 3-3.

previously discussed to translate the design methodology into practice. The Army teaches practitioners to use the environmental frame, problem frame, and solution space to generate a design concept. The design concept also contains reframing criteria. Working through the methodology occurs iteratively and often times simultaneously. Although the case studies focus primarily on environmental framing and reframing, it is difficult to completely work through the frames separately as they often inform each other as to the nature of the problematic situation.

Figure 1 demonstrates the links between the design foundations and the framing activities.

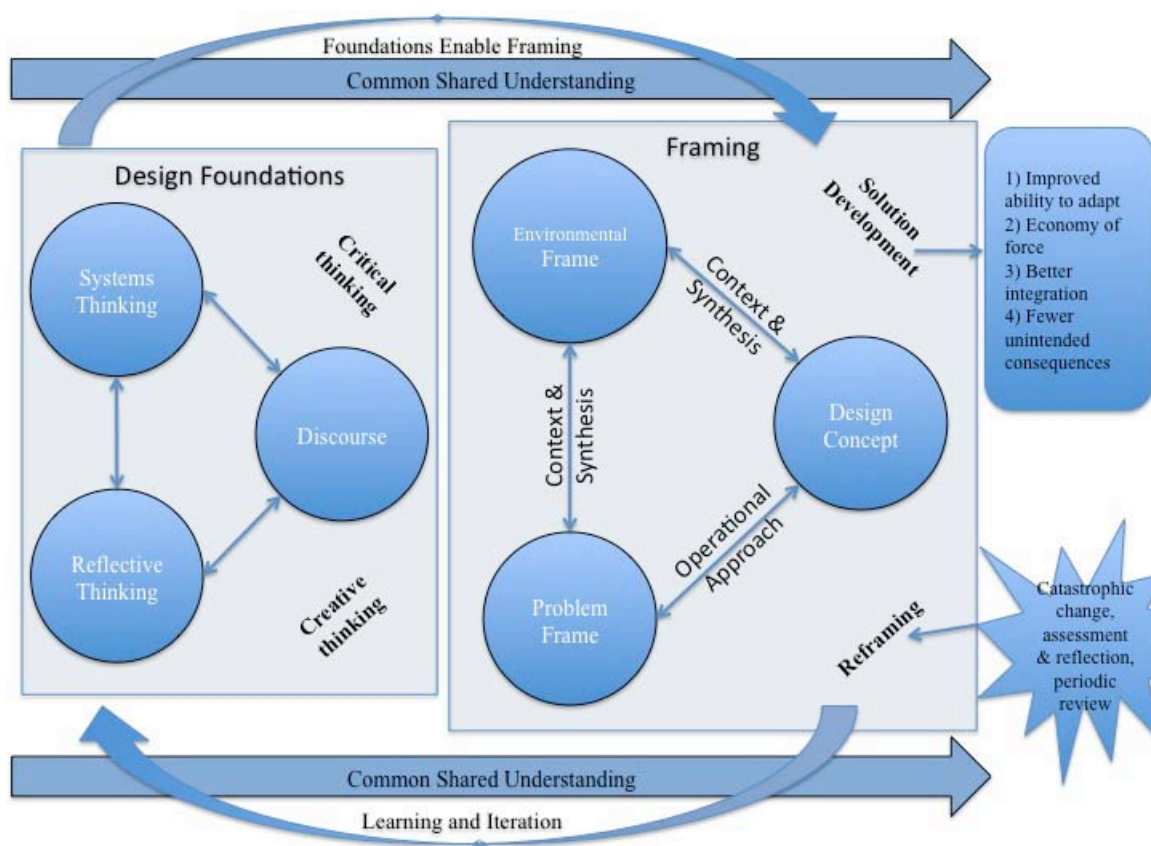


Figure 1. Relationship Between Foundations and Framing

Sources: Author with data from SAMS curriculum and Headquarters Department of the Army, Field Manual 5-0: *The Operations Process* [Washington D.C: Department of the Army, 2010], 3-13.

Environmental Frame

U.S. Army operational design begins with environmental framing. This step of the design methodology establishes the contextual understanding of the problematic situation. This is important because practitioners of design will “be unable to clearly state the problem until they

have a mature environmental frame.”³⁷ Environmental framing is more than JOPP or JAOP mission analysis. Environmental framing “captures the history, culture, current state, and future goals of relevant actors in the operational environment.”³⁸ The result of a complete environmental frame is a view of an adversary complex adaptive system in its current state but also future state. The future state is often referred to as the desired state, or what, after intervention the adversary state should look like.

Between these two states are a combination of system potentials, propensities and tensions. Propensity refers to the tendency of a system to continue in its current state without any type of intervention. Essentially, it helps identify the entire “range of possible futures if the system is allowed to evolve”³⁹ and “sets a baseline for understanding how the environment is expected to behave.”⁴⁰ Potential is “the inherent ability or capacity for the growth or development of a specific interaction or relationship.”⁴¹ Potential helps “confirm what range of desired future behavior is in the realm of the possible and what tensions must be mitigated or enhanced to achieve the desired system [state].”⁴² Lastly, tension is “the resistance or friction among and between actors.”⁴³ Identification of system tensions is important because they “can be exploited to drive change [and] are vital to transforming existing conditions.”⁴⁴ Tensions also “provide a

³⁷ Banach and Ryan, “The Art of Design: A Design Methodology,” 110.

³⁸ Headquarters Department of the Army, Field Manual 5-0: *The Operations Process*, 3-9. Colonel Banach and Dr. Ryan also identify historical contexts, cultural narratives, alliances, trends, conflicts, contingent relationships and points of disequilibrium as areas for exploration as well as the physical, moral, cognitive and cyber domains.

³⁹ Design D300 Student Text 2.0, *Design Glossary* [Fort Leavenworth: School of Advanced Military Studies, 2009]: 13.

⁴⁰ Banach and Ryan, “The Art of Design: A Design Methodology,” 111.

⁴¹ Headquarters Department of the Army, Field Manual 5-0: *The Operations Process*, 3-10.

⁴² Banach and Ryan, “The Art of Design: A Design Methodology,” 111.

⁴³ Headquarters Department of the Army, Field Manual 5-0: *The Operations Process*, 3-10.

⁴⁴ Headquarters Department of the Army, Field Manual 5-0: *The Operations Process*, 3-10.

way to obtain a deeper understanding of interactively complex systems.”⁴⁵ The resulting interplay between system propensity, potential and tension resulting from a mature environmental frame ultimately leads to the creation of an operational approach, discussed next in the problem frame.

Problem Frame

The problem frame “is a refinement of the environmental frame that defines . . . the areas for action that will transform existing conditions towards the desired end state.”⁴⁶ The problem frame further develops an understanding of the tensions identified for exploitation in what is referred to as the operational approach. Problem framing develops the operational approach by examining the friendly logic (referred to as the system of collaboration) and the adversary logic (referred to as the system of opposition).⁴⁷ Between these two systems, operational design identifies “creative tensions” and highlights “choices for intervention.”⁴⁸ When working in the problem frame practitioners of design will often move back and forth between this frame and the environmental frame. This occurs because tensions will be identified for action earlier in the methodology that are not fully understood and require further refinement. Put another way “initial understanding of the problem gained while developing the environmental frame is usually revealed as incomplete and may be partially invalid.”⁴⁹ This is why design is iterative and why practitioners of design move through the various frames not in a linear fashion but in most instances simultaneously. From the problem frame, a “decision on how to act to manage the

⁴⁵ Banach and Ryan, “The Art of Design: A Design Methodology,” 111.

⁴⁶ Headquarters Department of the Army, Field Manual 5-0: *The Operations Process*, 3-10.

⁴⁷ Banach and Ryan, “The Art of Design: A Design Methodology,” 112.

⁴⁸ Ibid.

⁴⁹ Ibid.

problem based on a direct or indirect approach or elements of both”⁵⁰ is made which moves the methodology into the design concept.

Design Concept

The design concept links together the work accomplished during the application of the Army’s operational design methodology to a standard military planning process such as JOPP or JAOP. The design concept can be depicted in any number of ways so long as the depiction retains the “intent and planning guidance communicating the logic of how intervention will occur and change behavior within the system.”⁵¹ The design concept is a broad approach that takes into consideration risks, resources, relationships, and appropriate learning mechanisms.⁵²

Incorporating learning mechanisms into the design concept is critical because a “concept that allocates resources to learning and adaption can better respond to unforeseen challenges and maintain relevance.”⁵³ Having appropriate learning mechanisms as a component of the design concept ensures “that success is recognized and built upon.”⁵⁴ Conversely, it also allows for early identification of a failed design concept that would cause a design practitioner to reframe.

Reframing

Reframing is the final aspect of operational design. By the very nature of interacting with a complex and adaptive system, it will react in a multitude of ways. Some of the ways will be predictable, others not. If the design concept is properly developed and articulated, then

⁵⁰ Christof Shaefer, “Design: Extending Military Relevance” *Military Review* [September-October 2009]: 33.

⁵¹ Stefan J. Banach, “Educating by Design: Preparing Leaders for a Complex World,” *Military Review* [March – April 2009]: 102.

⁵² Headquarters Department of the Army, Field Manual 5-0: *The Operations Process*, 3-12.

⁵³ Banach and Ryan, “The Art of Design: A Design Methodology,” 113.

⁵⁴ Ibid.

appropriate mechanisms are in place that, if necessary, highlights the need to reframe. General Mattis summed this up best when he wrote that “the enemy always gets a vote in the outcome” and that the “operational environment can change quickly and subtly.”⁵⁵ Reframing results when something occurs that calls into question the validity of the original design concept. Reframing is “triggered in three ways: a major event causes a ‘catastrophic change’ in the operational environment, a scheduled periodic review shows a problem, or an assessment and reflection challenges understanding of the existing problem and the relevance of the operational approach.”⁵⁶ Reframing provides the opportunity to ensure that operational design is not merely “doing the right thing,” but ensuring that the design concept is not “doing things right on the way to ‘worse’ or ‘irrelevant’ rather than ‘better’ outcomes.”⁵⁷

Operation CASTOR and the Battle for Dien Bien Phu

Operation CASTOR and the resulting battle for Dien Bien Phu demonstrate how the absence of design-like elements reduces the effectiveness of airpower in warfare. The lack of systems thinking led air planners to incorrectly believe they could provide sufficient logistical support to the French garrison while interdicting enough Viet Minh supplies to prevent them from generating overmatching combat power. What this also demonstrates is that the French did not understand the limitations of their supply system or the strengths of the Viet Minh system. The French used a technology driven system while the Viet Minh used a manpower type system. Once overburdened, the French technology based system did not adapt and broke down. The Viet Minh manpower based system was resilient, adaptable, and able to heal itself.

⁵⁵ Mattis, Memorandum for U.S. Joint Forces Command, 5.

⁵⁶ Headquarters Department of the Army, Field Manual 5-0: *The Operations Process*, 3-13.

⁵⁷ Wass de Czege, Huba. “Systemic Operational Design: Learning and Adapting in Complex Missions.” *Military Review* [January-February 2009]: 7.

The lack of reflective thinking caused air planners to uncritically support a faulty model of operations based upon previous French experience at Na-San. The failure to develop a mature environmental frame that addressed political and cultural tensions demonstrated a failure to understand the “other” leading to an underestimation of what the Viet Minh was capable of. Finally, the inability of the French to reframe at critical times limited what air planners were able to accomplish, ultimately reducing the effectiveness of airpower.

History

Operation CASTOR emerged from the desires of General Henri Navarre, the commander of French forces in Indochina, to stabilize a deteriorating situation across Vietnam and reverse the “rather grim picture of the situation he found on his arrival in Saigon.”⁵⁸ When General Navarre took command in 1953, the guidance provided to him by the French government was “not to destroy the Viet Minh or to win the war: it was to create the conditions for an ‘honourable way out’ – to achieve a position of military advantage that would allow France to negotiate a favourable peace.”⁵⁹ In response, he created the “Navarre Plan” of which a crucial piece was to “bring about a decisive battle and create the right conditions for an ‘honourable way out,’ as he had been requested to do by Rene Mayer.”⁶⁰ As General Navarre surveyed the situation across Indochina, he understood that the Viet Minh were strong enough in the north to threaten Laos. Concerned that Viet Minh success in Laos would violate the guidance he received, General Navarre began to generate options that would create a favorable military advantage for the French during future negotiations. In attempting to mitigate the threat to Laos and eliminate Viet Minh

⁵⁸ Jacques Dalloz, *The War in Indo-China, 1945-54*, trans. Josephine Bacon [Savage: Barnes and Noble Ltd., 1990, 158.

⁵⁹ Martin Windrow, *The Last Valley: Dien Bien Phu and the French Defeat in Vietnam*, [Cambridge: Da Capo Press, 2004], 205.

⁶⁰ Dalloz, *The War in Indo-China, 1945-54*, 161.

forces, French planners selected the valley of Dien Bien Phu to develop an air-land base. From Dien Bien Phu, French forces would execute a series of deep thrusts aimed at disrupting Viet Minh forces and defend Laos by blocking the main avenue of approach from northwest Vietnam. Economically the location was attractive because the valley “grew almost 2000 tons of a rice a year and had long been known as one of the most important opium collection and processing centers in all Indochina.”⁶¹ Occupying this area would deny the Viet Minh income from opium and food from the rice. Militarily, Dien Bien Phu had an airfield long enough to support C-47 operations, and it was thought by planners that the wide open terrain of the valley would allow for French forces to utilize their strengths in maneuverability and firepower against the Viet Minh. There were also local political reasons for the selection of Dien Bien Phu. In the vicinity of Dien Bien Phu there existed a large number of tribes who conducted guerrilla activities against the Viet Minh. Since these tribes were allied with the French, Dien Bien Phu could become a stronghold that would “provide an anchor for the Thai and Meo tribal partisans who had been operating successfully against the Viet Minh for two years.”⁶² It would signal to the tribal leaders that the French would not abandon them. Operation CASTOR became the best option to meet all of these diverse criteria.

When General Jean Dechaux, commander of Tactical Air Group/North and Colonel Jean-Louis Nicot, commander of the Indochina Air Transport group were notified of Operation CASTOR, they had immediate tactical reservations. General Dechaux stated that the “main concern was the safety of his transport planes,”⁶³ a sentiment echoed by Colonel Nicot in addition to his concern about the stress CASTOR would place on his overworked transport fleet. General

⁶¹ Bernard B. Fall, *Hell in a Very Small Place: The Siege of Dien Bien Phu*, [Cambridge: Da Capo Press, 1966], 9.

⁶² Windrow, *The Last Valley*, 218.

⁶³ Windrow, *The Last Valley*, 226.

Dechaux “also warned that providing fighter support would be difficult”⁶⁴ and that “the distances of 200 miles from Hanoi (the center of the airfield complex) to Dien Bien Phu would limit to a few minutes the time his fighter aircraft could spend over the target area.”⁶⁵ Finally, the weather “would also be a major factor” as “morning fog was a constant problem, and the Army must not expect uninterrupted air support.”⁶⁶ Daily airlift supply requirements were based off the French experience at Na-San, a base similar in composition to that planned for Dien Bien Phu. Estimates predicted a daily supply requirement of 80 tons per day, a figure Colonel Nicot admitted “was within the limits of possibility for his three squadrons, provided no other impossible calls were made upon them at the same time.”⁶⁷ Despite tactical misgivings, “no one raised any objections to the broad concept of the plan, only to the narrow details of its execution.”⁶⁸ General Navarre “said that he knew the air force could do the job in spite of the problems”⁶⁹ and issued the go-ahead for Operation CASTOR. In laying out the objectives to subordinate commanders, Navarre wrote “of strategic order: protection of Laos; of an economic order: seizure of rice, particularly in the valley of Dien Bien Phu.”⁷⁰ In a secret cable sent to the U.S. State Department, the American consul in Hanoi reported that the purpose of Operation CASTOR was “(1) to serve as [the] northern anchor of Laos defenses ... (2) to send out . . . attack parties in all directions to seek out [the] enemy and engage him; [and] (3) to foster [the] development of Thai guerrilla and partisan

⁶⁴ Ibid.

⁶⁵ Phillip B. Davidson, *Vietnam at War: The History 1946-1975*, [Novato: Presidio Press, 1988], 182.

⁶⁶ Windrow, *The Last Valley*, 226.

⁶⁷ Windrow, *The Last Valley*, 226.

⁶⁸ Ibid.

⁶⁹ Davidson, *Vietnam at War*, 184.

⁷⁰ Howard R. Simpson, *Dien Bien Phu: The Epic Battle America Forgot*, [Washington: Brassey's Inc., 1994], 4.

forces to supplement those already formed and based on Lai Chau.”⁷¹ As Operation CASTOR unfolded, the absence of design elements became apparent and despite the heroics of both Airmen and Soldiers, airpower was ineffective in staving off the destruction of the French garrison.

Design Foundations

In order to demonstrate how the lack of design elements limited airpower’s effectiveness in Operation CASTOR, it is necessary to start with the previously identified design foundations. The absence of systems thinking during the formulation of Operation CASTOR reduced airpower’s effectiveness. One of the key assumptions made by planners involved both friendly and enemy logistics. Planners assumed that the French Air Force could interdict enough enemy supplies to Viet Minh units around Dien Bien Phu and render them incapable of generating enough combat power to resist French offensive operations. In fact, “from the beginning of Operation ‘CASTOR,’ General Navarre insisted that the Air Force be given priority to attacks on the enemy lines of supply.”⁷² Effective interdiction requires a systemic understanding of the components enabling the enemy’s logistical capability as well as the components enabling enemy’s military forces because they interact to generate combat power. Interdiction holds that by reducing the supplies that flow from the enemy’s logistical system to the military system, a commensurate reduction of combat power will occur. AFDD 2-1.3 *Counterland Operations* states, “heavy ground combat creates demands on enemy fielded forces and speeds consumption of vital war materiel. This in turn increases the effects of AI [Air Interdiction] operations by straining the enemy support system and reducing stockpiles.”⁷³ For interdiction to be effective,

⁷¹ John R. Nordell Jr., *The Undetected Enemy: French and American Miscalculations at Dien Bien Phu, 1953*, [College Station: Texas A&M University Press, 1995], 29.

⁷² Windrow, *The Last Valley*, 272.

⁷³ Headquarters Department of the Air Force, Air Force Doctrine Document 2-1.3: *Counterland Operations*, [Washington D.C: Department of the Air Force, 2006], 23.

friendly forces must also act against the enemy military system in a manner that forces it to use more supplies than come into the system. The point becomes salient if modeling the Viet Minh as in Figure 2.

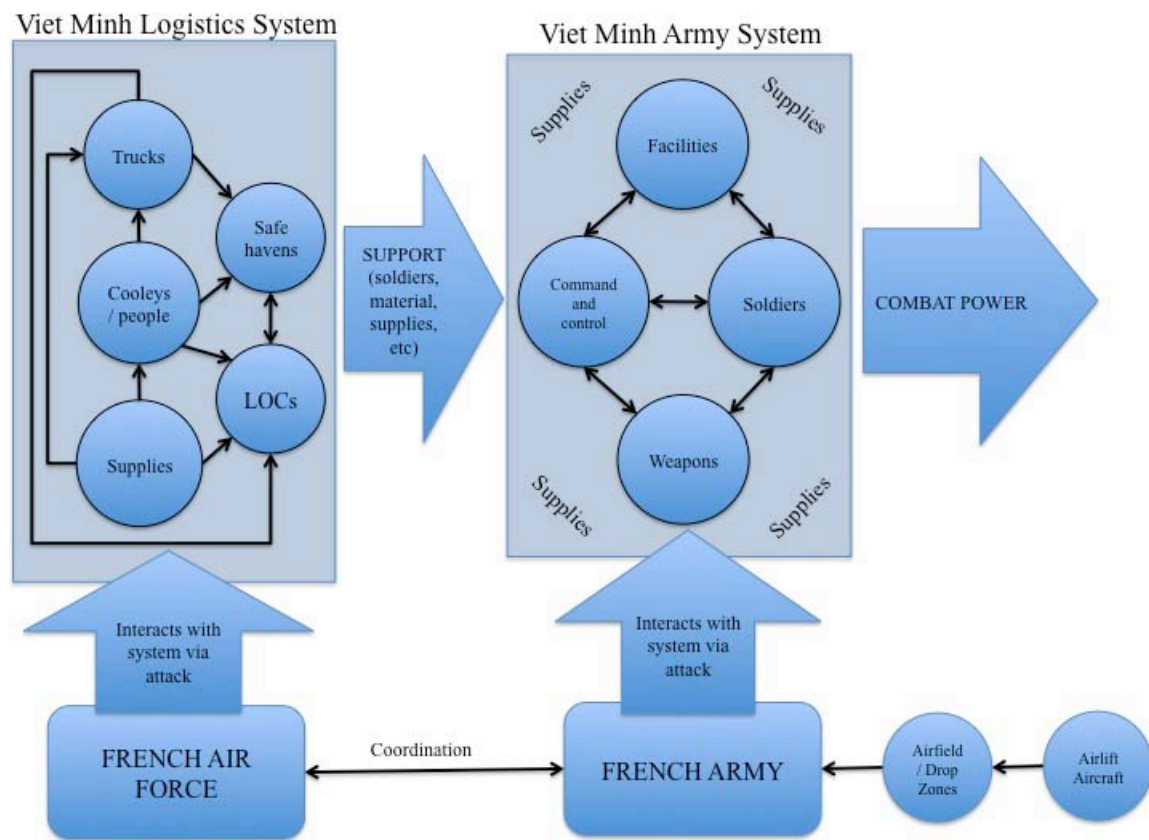


Figure 2. Viet Minh Logistics System Interdiction Model

Supplies from the logistics system flow into (input) the Viet Minh units around Dien Bien Phu (system), enabling them to generate combat power (output) against the French. In order to affect the Viet Minh military system and reduce their combat power, French forces must act both on the input (interdiction of the logistics system) but also directly on the Viet Minh military system itself. By engaging the Viet Minh in combat operations that force them to use more supplies than can be provided, the overall combat power generated by the system is reduced to such a level that remains either manageable by friendly forces or allows friendly forces to mount decisive operations to destroy the enemy. Interdiction of the logistics system input is only effective if another aspect of the system is exercised forcing the threshold to be breached. French

air planners never demonstrated this level of systemic understanding and continued supply interdiction despite the inability of French ground forces to generate a level of combat necessary to stress the Viet Minh army. As a result, the interdiction effort resulted in “too few bombs on too many targets”⁷⁴ allowing the Viet Minh’s logistical system to adapt to French efforts and to allow their military forces to exercise the advantage of time to build their stockpile.⁷⁵ Figure 3 depicts these results.

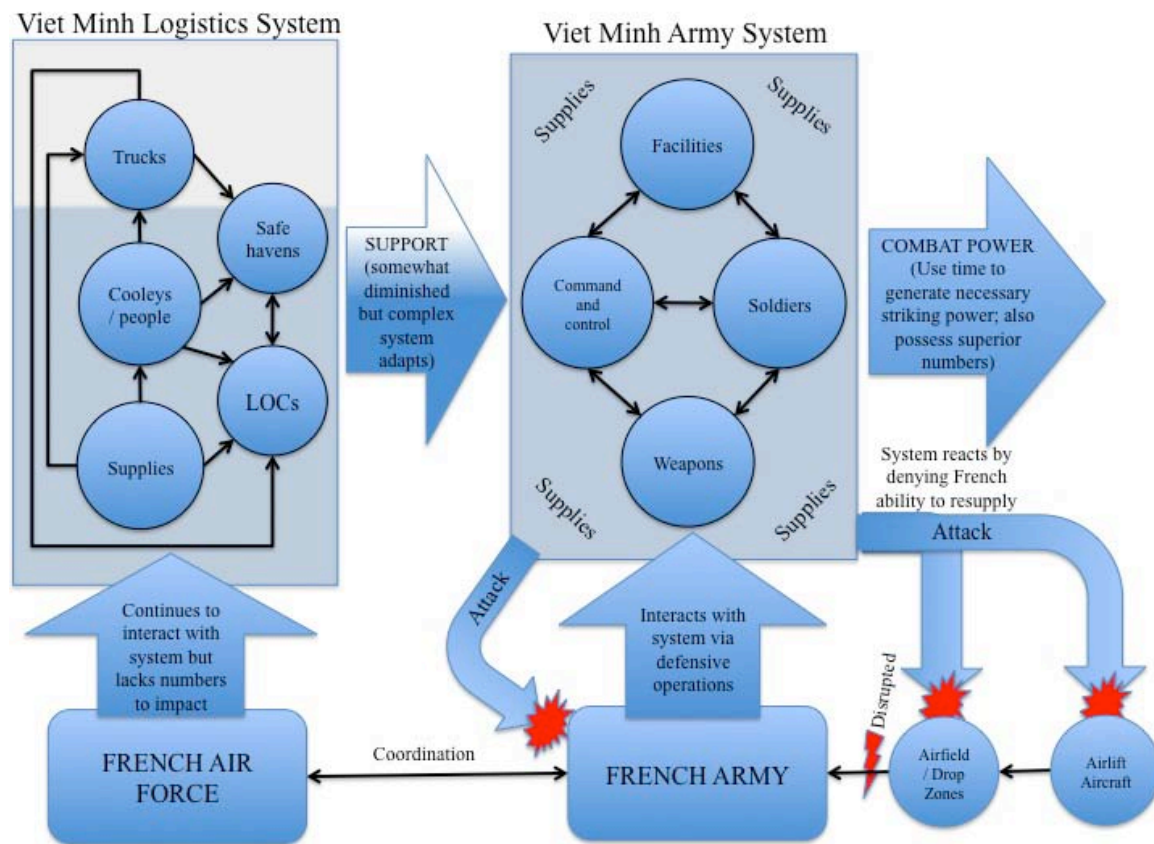


Figure 3. Viet Minh Logistics System Interdiction Model – Adaptation

⁷⁴ Windrow, *The Last Valley*, 273.

⁷⁵ Another way of looking at this is as a faucet and basin. In the book *Vietnam at War*, Lieutenant General Phillip Davidson proposed on page 217 that “in analyzing an air interdiction program, enemy supplies must be looked at as water running through a faucet into a basin. You can never shut off the faucet entirely, but you can reduce it to a trickle or even drops. Nevertheless, the basin will fill if friendly ground action is not pulling the plug in the basin, that is, if ground troops are not forcing the enemy to expend large amounts of his supplies. Interdiction is a joint air-ground operation, and this was where the French failed. They permitted the Vietminh to ‘fill the basin’ by not forcing them to use their supplies in combat.”

This type of systems thinking was absent from the French logistics perspective as well. As reports emerged around Dien Bien Phu of an increased Viet Minh presence, requests for troops and artillery increased. The “strain on Colonel Nicot’s transport fleet during the build-up of men and material at Dien Bien Phu had increased steadily – the garrison now numbered about 10,000 men in 12 infantry and two-plus artillery battalions.”⁷⁶ Much like the effects of interdiction on an enemy’s logistical system, the problem the French faced was as the amount of personnel increased on the ground, the more supplies were required and the greater effort would be needed by an already overburdened air transport fleet. In the operations order that General Dechaux received for CASTOR, planners envisioned “the eventual stationing of five battalions, two of which would roam throughout the surrounding area.”⁷⁷ As was just demonstrated the French exceeded that figure by seven battalions. This increase in forces, while attempting to match the complexity of the environment, was merely a form of passive adaption. Figure 4 depicts this cycle and illustrates the interconnectedness between the two logistical systems.

⁷⁶ Windrow, *The Last Valley*, 297.

⁷⁷ Fall, *Hell in a Very Small Place*, 4.

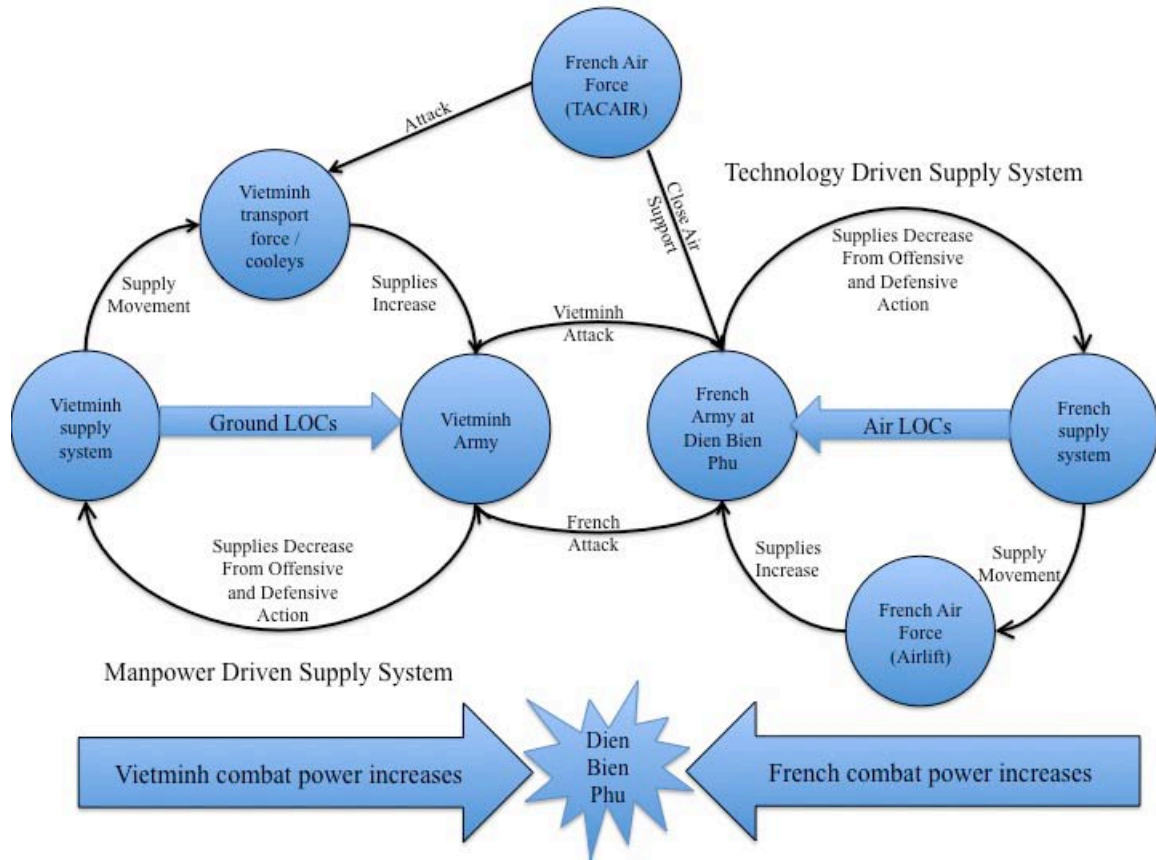


Figure 4. Interaction Between French and Viet Minh Logistical Systems

Systems thinking might have led the French to develop a threshold of total forces that once exceeded would preclude the successful sustainment of ground forces by air. This in turn might have led to the development of reframing criteria based on this identified threshold. An overburdened air transport system was asked for more than it could provide, resulting in the ineffective use of airlift and later airdrop. Simply put, the French logistical system lacked the complexity commensurate with the environment while the Viet Minh logistics system, with its remarkable ability to heal and adapt, was far better suited for the environment.⁷⁸

⁷⁸ Yaneer Bar-Yam in the book *Making Things Work* provides excellent rationale why this is important. On page 67, he states “being complex is the only way to succeed in a complex environment” because “higher complexity organisms have more behavioral options, which in turn enables more right choices.” He then writes, “in general, larger scale challenges should be met with larger scale responses. The rule of thumb is that the complexity of the organism has to match the complexity of the environment at all scales in order to increase the likelihood of survival.” The French garrison, with its single method of supply by air and limited numbers to defend vital areas needed to recover supplies, was no match for a complex

The lack of another design fundamental, reflective thinking, committed the French Air Force to a paradigm with little chance of enhancing airpower's effectiveness during Operation CASTOR. As mentioned earlier, reflective thinking is an important feature of design because it allows practitioners to think critically about assumptions and the logic behind certain actions and directives. It also considers the second and third order effects of past and future action. In the case of French air planners in Operation CASTOR, tactical objections were raised but fundamentally no one questioned the viability of the basic premise of CASTOR: the establishment of a fortified air-land base fashioned after Na-San. The most likely reason for this is due to French success at Vinh-Yen and Na-San where friendly positions were sustained primarily by interdiction and airlift operations. In the case of Na-San, "the air bridge from Hanoi had functioned"⁷⁹ and "the air force had no difficulty in supporting army operations at Na-San, and had evacuated the whole garrison of 1500 men with no interference from the Viet Minh."⁸⁰ From these experiences "the French learned the lesson that one could establish an 'air-land' base deep in enemy territory, maintain it by airlift, and compel the Viet Minh into a set-piece battle in which French firepower would decimate the Viet Minh."⁸¹ Na-San had become "the shining symbol of French ability to withstand a massive Communist assault on an organized position."⁸² One of the key assumptions in constructing such a base was in the event of a Viet Minh attack, the "French Air Force would be able to sway any battle in the defender's favour. It was believed that the artillery and combat aircraft would together form a hammer to smash the People's Army on the anvil of the ground

Viet Minh military system that could resupply by a variety of ground LOCs, using a variety of methods, with seemingly endless manpower to facilitate the delivery and movement of provisions.

⁷⁹ Simpson, *Dien Bien Phu: The Epic Battle America Forgot*, 7.

⁸⁰ Donald R. Backlund, "Stalingrad and Dien Bien Phu: Two Cases of Failure in Strategic Resupply," *Aerospace Historian* 17 [Summer-Fall 1970]: 65.

⁸¹ Corum and Johnson, *Airpower in Small Wars*, 157.

⁸² Fall, *Hell in a Very Small Place*, 24.

defences.”⁸³ The French clung to the air-land base concept because it provided a “solution to one of the key problems which faced French commanders . . . how to spread a sufficient degree of insecurity into the enemy’s own rear areas so as to compel him in turn to disperse his troops for the purpose of protecting those areas.”⁸⁴ What is clear is that although air planners expressed concern over some of the tactical details of Operation CASTOR, no evidence indicates that any serious reflection occurred on the basic concept of the air-land base. Planners did not reflect on why Vinh-Yen and Na-San were successful and why it was assumed Operation CASTOR would follow a similar path. They also never questioned what the follow on effects of Operation CASTOR would be if successful. How long would the garrison need to be supplied, and under what conditions would such support be untenable? Certainly, weather and the long-term availability of aircraft were a concern, but failure to reflect on the basic strategy limited the effectiveness of airpower by committing it to a plan that had significant conceptual flaws. This lack of reflective thinking may have resulted from the very nature of the planners themselves. Many “of the French headquarters officers responsible for the planning of Dien Bien Phu saw the Vietminh as basically a guerrilla force, a ‘peasant’ army” which “made it difficult for them to imagine facing enemy divisions willing to stand and fight.”⁸⁵ This lack of cultural appreciation leads to the next series of absent design elements, framing.

Framing

In addition to the missing foundational aspects of design, Operation CASTOR demonstrates how the lack of design’s framing activities limited the effectiveness of airpower. Despite known tactical concerns over the French Air Force’s ability to support CASTOR, French

⁸³ Windrow, *The Last Valley*, 553.

⁸⁴ Fall, *Hell in a Very Small Place*, 30.

⁸⁵ Howard R. Simpson, “The Lessons of Dien Bien Phu,” *Military Review* [January 1992]: 68.

air planners proved unable to demonstrate the operational harm these concerns would cause. Their inability to link them to a greater operational perspective committed airpower to plan with minimal chance of success. This stems from the fact that there was not a holistic view of the operational environment that, had framing been used, would have enabled air planners to better manage the complexity of the Viet Minh insurgency. Design's environmental frame is instructive and might have elevated the difficulties French airpower faced beyond mere tactical relevance.

One of the requirements during environmental framing is to develop a cultural narrative for both enemy and friendly forces. In the case of Operation CASTOR, air planners clearly subscribed to the view prevalent within the French military. As just discussed, the French Air Force viewed the Viet Minh as a peasant army. Unfortunately what existed was a complete “difference in lifestyles, in cultures, and above all, a difference in dedication, devotion, and the amount of physical discomfort and suffering each contender was willing to suffer for victory.”⁸⁶ Lack of a cultural narrative reinforced the perception that the Air Force, despite the odds, could handle any surprises the Viet Minh produced. If, for whatever the reason, the Viet Minh's “primitive logistics” managed to deliver a “miracle,” any “Vietminh guns appearing at Dien Bien Phu would be neutralized quickly by artillery fire and air strikes.”⁸⁷ Because of French air superiority over the region, “the Vietminh would be unable to transport their alleged 105mm guns across North Vietnam under skies ruled by the Air Force.”⁸⁸ Had some form of environmental framing been accomplished for Operation CASTOR, questions should have emerged about the tension between the Viet Minh and why the French believed they were a peasant army, incapable of producing the type of logistical feat that would eventually prove this perspective wrong. Ample evidence existed from the level of resistance encountered at Vinh-Yen and Na-San that the

⁸⁶ Davidson, *Vietnam at War*, 234.

⁸⁷ Simpson, *Dien Bien Phu: The Epic Battle America Forgot*, 35.

⁸⁸ Windrow, *The Last Valley*, 347.

Viet Minh were moving beyond simple peasants incapable of concerted action. Furthermore, there existed personnel within the French Air Force who understood that Viet Minh culture enabled remarkable feats of logistics. An interview by Pierre Guin, a platoon leader of an air supply company during Operation CASTOR, noted that the French command “seems to have forgotten the Viet Minh ‘ant concept’ of logistics. We had seen it operate at Nghia-Lo, but nobody asked our advice.”⁸⁹ The absence of a cultural narrative and the questions about the tensions such a narrative fosters were evident in French planning for CASTOR. Planners never questioned basic cultural assumptions, leading the French Air Force to support an operation that disregarded key enemy capabilities. Bernard Fall wrote that “the underestimation of the Viet Minh’s capabilities was perhaps the only *real* error made by the French commander-in-chief,”⁹⁰ a perspective echoed 10 years earlier by the Artillery faculty of the Command and General Staff College when they simply stated “Viet Minh capabilities were grossly underestimated.”⁹¹

Another aspect of the environmental frame air planners neglected was the investigation of the tension that existed between their operations in support of CASTOR and the link to French politics. General Navarre’s intent for Operation CASTOR was already discussed. Navarre directed that the “mission of the Air Force shall be until further orders, given priority and with the maximum means at its disposal, to the support of our forces in the Northwest” and that “the Commanding General of the Air Force in the Far East will, to that effect, reinforce the Northern Tactical Air Group.”⁹² Once ordered to support Operation CASTOR, there was no discussion of how air efforts supported the achievement political objectives. Clearly one of the key assumptions General Navarre operated under was the importance of defending Laos by disrupting and

⁸⁹ Jerry V. Smith, “Adieu at Dien Bien Phu,” *Vietnam* [October 2008]: 52.

⁹⁰ Fall, *Hell in a Very Small Place*, 50.

⁹¹ Norman E. Martin, “Dien Bien Phu and the Future of Airborne Operations,” *Military Review* [June 1956]: 24.

⁹² Fall, *Hell in a Very Small Place*, 45.

preventing planned Viet Minh incursions. As conditions changed around the base Navarre “issued a directive stating his intention to wage a pitched battle for the base.”⁹³ The Air Force never objected to this goal or the prospect of what Operation CASTOR was to achieve. Any objections were tactical, “based on weather, antiaircraft fire, aircraft maintenance problems, inadequate time-over-target, and attrition of fuel, engines and airmen.”⁹⁴ Remember, however, that despite the problems these tactical issues presented, neither the commander of the Air Transport Group or the Tactical Air Group/North “questioned the possibility of maintaining the air bridge,”⁹⁵ just that it would be difficult. Had air planners sought to frame their support with regard to political conditions, they might have learned that “Navarre had no clear mission to defend Laos.”⁹⁶ Furthermore, nearly two weeks into Operation CASTOR General Navarre “received a letter from the National Defense Committee relieving him of any obligation to defend Laos.”⁹⁷ Had the French Air Force concerned themselves with understanding the political aspects behind Operation CASTOR, they may have been able to link their tactical misgivings to a broader operational framework. In other words, the absence of this particular aspect of the environmental frame prevented air planners from asking the question, why develop an operation that inherently limits the effectiveness of airpower and is not in accordance with the desires of the French political leadership?

The final aspect of design absent from Operation CASTOR is reframing and reframing criteria. Three issues surfaced during planning that should have caused a reframe of the concept or at least forced the development of specific reframing criteria. The first instance that should

⁹³ John Prados, “Assessing Dien Bien Phu,” in *The First Vietnam War: Colonial Conflict and Cold War Crisis*, ed. Mark Atwood Lawrence and Fredrik Logevall, [Cambridge: Harvard University Press, 2007], 219.

⁹⁴ Davidson, *Vietnam at War*, 184.

⁹⁵ Windrow, *The Last Valley*, 228.

⁹⁶ Davidson, *Vietnam at War*, 184.

⁹⁷ Davidson, *Vietnam at War*, 201.

have caused a reframe stems from the numerous tactical issues raised by senior French Air Force personnel. Due to the tactical challenges espoused by the service upon which the very success of CASTOR was dependant, General Navarre and his HQ staff at the very least should have paused to reconsider how CASTOR was implemented. The Army's design methodology accepts that "orders flow from higher to lower, but understanding often flows from lower to higher, especially when operational problems are complex."⁹⁸ The methodology also states that "recognizing when an operation – or planning – is not progressing as envisioned . . . provides the impetus for reframing."⁹⁹ The failure to reframe likely occurred because these tactical issues were not in any way linked to a broader operational perspective that would have increased not only their own but higher HQs understanding of the problematic situation CASTOR was supposed to effect. Essentially the air planner's concerns were marginalized because they, due to the lack of design fundamentals and environmental framing, could not express the larger ramifications of their issues. This is clear from General Navarre's reaction to the Air Force's concerns. After considering the tactical challenges Air Force personnel raised, General Navarre "quietly said that he knew the air force could do the job in spite of the problems and concluded . . . by announcing that Operation CASTOR would be carried out."¹⁰⁰ The absence of reframing necessitated that the Air Force support a plan that from the beginning limited the overall effectiveness of airpower, underestimated the enemy, and subjected the French to fundamental surprise.

During the development of Operation CASTOR planners stipulated "the importance of protecting the airstrip from enemy fire,"¹⁰¹ especially if Dien Bien Phu's only means of supply was by air. This need to ensure access was reiterated by General Navarre to his commanders

⁹⁸ Headquarters Department of the Army, *TRADOC Pamphlet 525-5-500*, 5.

⁹⁹ Headquarters Department of the Army, *Field Manual 5-0: The Operations Process*, 3-13.

¹⁰⁰ Davidson, *Vietnam at War*, 183.

¹⁰¹ Windrow, *The Last Valley*, 226.

during the commencement of CASTOR. Ground commanders were to “guarantee at the very least the free usage of the airfield.”¹⁰² This was predicated on two assumptions, the first that a perimeter would be wide enough to ensure freedom of movement around the airfield as well as to prevent indirect fire from threatening the runway. The second assumption was that the garrison would prevent any significant Anti-Aircraft Artillery (AAA) threat to the airlift effort. As previously mentioned, “the French High Command had already declared the transport” of large caliber weapons “impossible because of the mountains, the lack of passable roads, and the enemy’s primitive logistics.”¹⁰³ Even if some large AAA pieces managed to make their presence known around Dien Bien Phu, they would be “neutralized quickly by artillery fire and air strikes.”¹⁰⁴ As will be shown, the failure to establish reframing criteria based on the potential inability of French forces to eliminate the threat of large caliber AAA caused a further reduction in the effectiveness of airpower (beyond that which was already inherent to the plan).

The second opportunity to reframe occurred with the abandonment of Lai Chau. Lai Chau was important to the French as a key defensive anchor that prevented the Viet Minh from threatening the airfield. Leaving the village was a serious development as “the minimum mission of maintaining freedom of movement within a radius of five miles around Dien Bien Phu’s airfield was in danger.”¹⁰⁵ By losing Lai Chau, the Viet Minh began tightening the noose around Dien Bien Phu and could begin to threaten the airfield. The third opportunity occurred during the build up phase of Operation CASTOR. The “lumbering transports that landed in a steady stream on the dust-covered airfield . . . experienced something that until now had been a rarity in the

¹⁰² Fall, *Hell in a Very Small Place*, 40.

¹⁰³ Simpson, *Dien Bien Phu: The Epic Battle America Forgot*, 35.

¹⁰⁴ Ibid.

¹⁰⁵ Nordell, *The Undetected Enemy*, 129.

Indochina war – Communist antiaircraft artillery.”¹⁰⁶ The presence of “37mm AA guns . . . were a revelation.”¹⁰⁷

Both instances, the loss of freedom of movement around the airfield and the presence of strong AAA, should have alerted air planners that the conditions were no longer consistent with the original concept of CASTOR. However, no reframe occurred and the French Air Force continued to support the plan in its original form. As aircraft damage and losses mounted, the lack of reframing speaks for itself. Once freedom of movement was lost, “the hidden Viet Minh batteries quickly made the airstrip untenable.”¹⁰⁸ The “loss of the use of the airstrip found the French relying on low-level parachute drops for supply.”¹⁰⁹ Once this happened, the 37mm AAA decreased the efficiency of the supply effort further. Using the loss of the perimeter to their advantage, the Viet Minh “antiaircraft artillery moved closer, supply plane losses mounted, and drops had to be made at higher altitudes with reduced effectiveness.”¹¹⁰ In addition to dropping at higher altitudes, “supplies and reinforcements for the garrison were parachuted at night to avoid antiaircraft fire.”¹¹¹ In order to ensure the ability to recover supplies dropped at high altitude and night, larger drop zones were required due to the loss of accuracy caused by dropping under these conditions. The ultimate result of this failure to reframe was that the garrison was “caught in a vicious cycle in which the maintenance of wider supply drop zones would have required the presence of larger troop reserves, and in which the presence of larger troop reserves would have

¹⁰⁶ Fall, *Hell in a Very Small Place*, 79.

¹⁰⁷ Windrow, *The Last Valley*, 277.

¹⁰⁸ Simpson, “The Lessons of Dien Bien Phu,” 68.

¹⁰⁹ Davidson, *Vietnam at War*, 244.

¹¹⁰ Martin, “Dien Bien Phu and the Future of Airborne Operations,” 23.

¹¹¹ Simpson, “The Lessons of Dien Bien Phu,” 68.

required a further upward spiraling of supply requirements.”¹¹² Based upon the information presented, this was a situation with no hope of correction.

The lack of systems and reflective thinking, the lack of environmental framing, and failure to reframe in the face of so many instances where it was necessary limited the effectiveness of airpower. The lack of systems thinking ensured the French Air Force’s interdiction efforts occurred in isolation of the Army’s activities, resulting in the loss of effectiveness. Failure to reflect on the basic model of Na-San as a foundation for Operation CASTOR led the Air Force to uncritically support a concept, despite tactical misgivings, that would never allow the full effectiveness of airpower to emerge. The absence of a mature environmental frame that appreciated the political tensions of the operation the Air Force was to support or the cultural aspect of the enemy committed the Air Force to supporting a plan with faulty assumptions. The inability to reframe or develop reframing criteria ensured the French Air Force’s tactical concerns remained detached from a broader operational perspective. The result was that as Operation CASTOR and the subsequent siege at Dien Bien Phu unfolded, the French Air Force passively adapted to the Viet Minh, limiting the effectiveness of airpower.¹¹³

Operation Linebacker II

Operation LINEBACKER II is an example of how the presence of design-like elements increases the effectiveness of airpower in warfare. The use of systems thinking enabled SAC’s planners to determine which targets best accomplished political objectives. Reflective thinking ensured that the air campaign developed with sound rationale and when some of the rationale later proved faulty, enabled the air campaign to adapt, increasing airpower’s effectiveness. The

¹¹² Fall, *Hell in a Very Small Place*, 453.

¹¹³ Remember that Jamshid Gharajedaghi noted on page 55 of *Systems Thinking* that “organizations bleed to death by adapting to an imperceptible gradual change, always doing too little too late” and that “passive adaptation to a deteriorating environment is a road to disaster.”

presence of a mature environmental frame as well as the ability to reframe when required increased the effectiveness of airpower and resulted in the completion of both political and military objectives.

History

Operation LINEBACKER II began as an attempt to coerce the North Vietnamese back to negotiations in the winter of 1972. To understand why the U.S. conducted this operation it is necessary to first examine the events immediately preceding it. In the spring of 1972, North Vietnam launched a massive attack against the South dubbed “the Nguyen Hue offensive.”¹¹⁴ Between April and October 1972, the U.S. and its South Vietnamese ally blunted the communist attack. The Americans succeeded in “isolating North Vietnam from its sources of supply and . . . wrecking its internal transportation system.”¹¹⁵ In “South Vietnam, the PAVN was mauled by American bombs and decimated by a stubborn ARVN resistance.”¹¹⁶

Continuing in this fashion negatively affected northern goals and “by late summer 1972 Hanoi had good reason to want the Americans out of the war.”¹¹⁷ The Nguyen Hue offensive “failed to deliver victory and the homeland was suffering the kind of damage which, if it continued, would make the future bleak.”¹¹⁸ Although Hanoi hoped that political forces would eventually cause the U.S. to withdrawal if they waited long enough, “there was no guarantee that this course of events would happen before air power had decimated PAVN forces to the point

¹¹⁴ Earl H. Tilford Jr., *Setup: What The Air Force Did in Vietnam and Why* [Alabama: Air University Press, 1991], 224.

¹¹⁵ Tilford, *Setup: What The Air Force Did in Vietnam and Why*, 253.

¹¹⁶ Ibid.

¹¹⁷ Tilford, *Setup: What The Air Force Did in Vietnam and Why*, 248.

¹¹⁸ Tilford, *Setup: What The Air Force Did in Vietnam and Why*, 248.

they might be incapable of successful combat.”¹¹⁹ LINEBACKER I ended in October 1972 when America, North Vietnam, and South Vietnam began negotiations. Although negotiations were by no means smooth, they progressed well enough that Henry Kissinger declared, “We believe that peace is at hand. We believe an agreement is in sight.”¹²⁰

Unfortunately, talks stalemated in late November and “on 13 December the North Vietnamese walked out of the peace talks.”¹²¹ Kissinger noted that “there was no intractable, substantive issue separating the two sides, but rather an apparent North Vietnamese determination not to allow the agreement to be completed.”¹²² Whether North Vietnam figured that Congress would end funding for U.S. operations or that it could exacerbate tensions between Washington and Saigon, they thought, at the very least, time would allow the insurgency to extract better terms. Regarding Congress, Hanoi was correct. President “Nixon understood that he had less than two months before the new Congress would arrive to cut off funding for further air action.”¹²³ To prevent this from ever being an issue Nixon ordered Haiphong harbor reseeded with mines on 14 December and the development of a massive air campaign against North Vietnam to commence 72 hours later. On 18 December, the U.S. began a bombing campaign, LINEBACKER II, designed to fulfill the political goals of President Richard Nixon.

Operation LINEBACKER II progressed in three phases totaling 11 days of intense bombing. Phase one occurred from 18–20 December and was a maximum effort using three waves of bombers flying similar ingress and egress routing to objectives around Hanoi. Phase one ended with three bombers destroyed on night one and six on night three by North Vietnamese

¹¹⁹ Ibid.

¹²⁰ Karl J. Eschmann, *Linebacker: The Untold Story of the Air Raids Over North Vietnam* [New York: Ivy Books, 1989], 62.

¹²¹ Eschmann, *Linebacker: The Untold Story of the Air Raids Over North Vietnam*, 73.

¹²² Tilford, *Setup: What The Air Force Did in Vietnam and Why*, 252.

¹²³ Wayne Thompson, *To Hanoi and Back: The USAF and North Vietnam, 1966-1973* [Washington, D.C: Air Force History and Museums Publishing: 2000], 258.

SAMs. In response to these losses President Nixon extended the bombing indefinitely, ensuring the North Vietnamese would not be emboldened by their perceived success. The losses also generated changes in tactics, ingress and egress routing, as well the amount of support aircraft employed and the types of Electronic Countermeasures (ECM) used. Phase two lasted from 21 to 24 December, during which “continued pressure was maintained . . . but at a reduced sortie level.”¹²⁴ It was during this phase that “SAM storage and assembly areas were aggressively targeted.”¹²⁵ The results of this phase were the continued destruction of the North’s infrastructure and the loss of only two bombers. Refinement of the campaign continued and the North Vietnamese were granted a bombing pause for Christmas. Phase three began on 26 December and lasted until 29 December. This phase concentrated on both Hanoi and Haiphong, and witnessed the most intense effort of the campaign with 120 bombers alone striking Hanoi on the 26th. Phase three resulted in the destruction of virtually every strategic military target and the exhaustion of North Vietnam’s Integrated Air Defense. An additional four bombers were lost bringing the total to fifteen.

The results of Operation LINEBACKER II were impressive. There was “severe damage to the North Vietnamese logistic and war-supporting capability.”¹²⁶ There was a “complete disruption of rail traffic within 10 nautical miles of Hanoi and a serious degradation of rail movement on the northeast rail line and the Thai Nguyen rail loop.”¹²⁷ The country’s “electric power generating capacity fell from 115,000 to 29,000 kilowatts, and the raids reduced POL

¹²⁴ Herman L. Glistner, *The Air War in Southeast Asia: Case Studies of Selected Campaigns* [Maxwell Air Force Base: Air University Press, 1993], 75.

¹²⁵ Gary H. Williams, “Operation LINEBACKER II: An Analysis in Operational Design,” [thesis, Naval War College, Newport: Naval War College, 1997], 10.

¹²⁶ Glistner, *The Air War in Southeast Asia*, 114.

¹²⁷ Ibid.

[Petroleum Oil, Lubricants] supplies by one-fourth.”¹²⁸ Although the psychological impact is difficult to assess, “some reports indicated that for the first time during the war, people were anxious to leave the cities.”¹²⁹ In another instance, “foreigners in the Gia Lam airport discovered workers wandering around completely disoriented following a strike.”¹³⁰ American POWs also provide an evaluation of LINEBACKER II’s effectiveness. It was common practice whenever a POW put their hands on the cell bars for guards to “try to smash the prisoner’s fingers with rifle butts. When the guards heard the long strings of B-52 bombs going off nearby, there was no such reaction.”¹³¹ During another B-52 strike, a POW saw “a guard, trembling like a leaf, drop his rifle and wet his pants.”¹³² Perhaps the ultimate validation comes from the North Vietnamese themselves. “It should be noted that the North Vietnamese did return to the peace conference table following LINEBACKER II.”¹³³

Design Foundations

Examining the design foundations in Operation LINEBACKER II demonstrate how these elements increased the effectiveness of airpower. Systems thinking was evident in the way Strategic Air Command planners eliminated the main threat to the B-52s, the SAM component of the air defense network. Systems thinking allowed planners to destroy the SAM logistical system, rendering this aspect of the air defense network incapable of generating the combat power necessary to stop the bombers. Reflective thinking was present throughout the planning and

¹²⁸ Mark Clodfelter, *The Limits of Air Power: The American Bombing of North Vietnam* [New York: The Free Press: 1989], 195.

¹²⁹ Glistner, *The Air War in Southeast Asia*, 114.

¹³⁰ Clodfelter, *The Limits of Air Power*, 195.

¹³¹ James R. McCarthy and George B. Allison, *LINEBACKER II: A View From the Rock*, ed. Robert E. Rayfield [Alabama: Airpower Research Institute, 1977], 174.

¹³² McCarthy and Allison, *LINEBACKER II: A View From the Rock*, 174.

¹³³ Glistner, *The Air War in Southeast Asia*, 114.

execution of LINEBACKER II. During the preparation for LINEBACKER II, planners consistently reflected-on-action regarding the merits and drawbacks of selected employment methods. In execution, these same planners reflected-in-action and made adjustments to operations in order to increase the effectiveness of airpower.

SAC planners demonstrated systems thinking in how they destroyed North Vietnam's SAM threat. Initial guidance for Operation LINEBACKER II stated that planners should not expend a significant amount of effort dismantling North Vietnam's SAM system, though if a situation warranted it they could attack. According to the 17 December message from the JCS, "North Vietnamese Air Order of Battle, airfields, and active Surface-to-Air-Missile sites may be struck as tactical situation dictates to improve effectiveness of attack forces and minimize losses."¹³⁴ There were several reasons for this. First, it was deemed that sufficient protection existed between the B-52's electronic countermeasures suite and other supporting ECM aircraft. Second, fighter aircraft would eliminate enemy planes that managed to threaten the bombers. Finally, the "air chiefs did not devise Linebacker II to achieve air superiority. The time constraints attached to the campaign dictated an immediate assault, and continued pressure was necessary to secure favorable results."¹³⁵ This accounts for the initial reactive nature of LINEBACKER II against only the SAM system and not the supply apparatus.

As the bombing progressed, night three made apparent the necessity to eliminate the SAM threat to participating aircraft. SAC planners demonstrated systemic thinking by understanding that in order to remove the SAM threat, action was necessary against the elements comprising the SAM system as well as its supply apparatus. This plan is depicted in figure 5.

¹³⁴ Eschmann, *Linebacker: The Untold Story of the Air Raids Over North Vietnam*, 74.

¹³⁵ Clodfelter, *The Limits of Air Power*, 185.

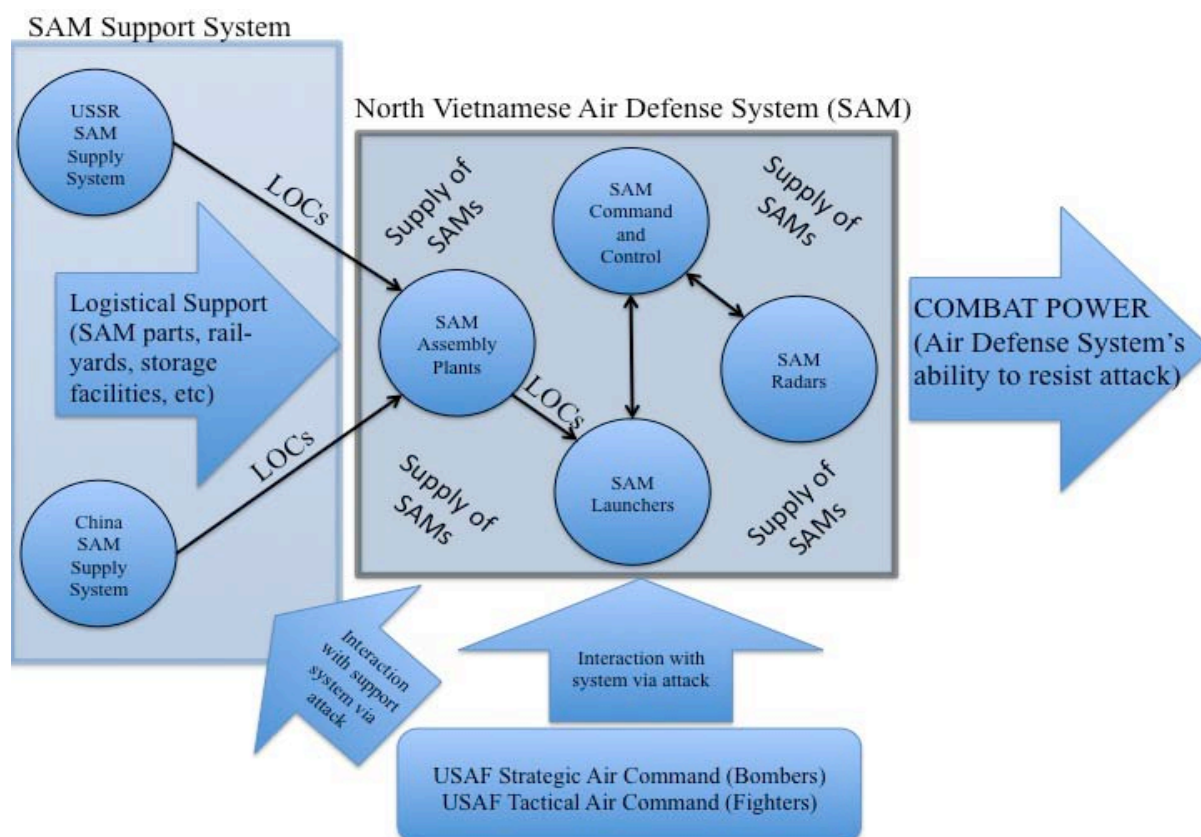


Figure 5. SAC Interdiction Plan Against SAM and SAM Support System

By attacking components of the SAM system (launchers, radars, command and control facilities, etc.) planners knew the sites would continue to defensively expend ordinance. Interdicting supply routes and storage facilities ensured that the SAM sites could not resupply. Accomplishing these actions would render North Vietnam's Air Defense system impotent and aircraft participating in LINEBACKER II could roam the skies uncontested. Planners knew that "North Vietnam had no SAM production facilities. It imported the missiles by rail or sea, and then assembled them."¹³⁶ Furthermore, "none of the SAM sites had spares" thus "the new primary targets became SAM sites and SAM munitions storage facilities."¹³⁷ During Phases two and three

¹³⁶ Tilford, *Setup: What The Air Force Did in Vietnam and Why*, 261.

¹³⁷ William P. Head, *War From Above the Clouds: B-52 Operations during the Second Indochina War and the Effects of the Air War on Theory and Doctrine* [Maxwell Air Force Base: Air University Press, 2002], 83.

“preemptive Navy strikes against SAM sites and the sudden concentration of [the] strike force all combined to overwhelm the enemy and his defensive system.”¹³⁸ Planners also ensured the continued mining of Haiphong Harbor and the interdiction of Lines Of Communication (LOCs) to prevent the resupply of missiles from China and Russia. This ensured “there were no replacements since the mining of Haiphong had cut them [North Vietnamese] off from their Soviet suppliers.”¹³⁹ The success of using systems thinking to eliminate the SAM threat and the increased effectiveness this had on airpower is striking. North Vietnam’s “defenses, while deadly at their peak effectiveness, had proven unable to maintain the high level of pressure necessary to stop the bombers.”¹⁴⁰ This is because the successful attacks on “SAM storage facilities, the mining of Haiphong harbor, air interdiction of rail and road transport nodes, and the high SAM usage rate resulted in depletion of missile stocks.”¹⁴¹ Put another way “North Vietnam had depleted their SAM supply, F-4s had wrecked their largest missile assembly facility, [and] their command and control system was degraded” resulting in a North Vietnam that “was virtually defenseless against B-52 attacks.”¹⁴² Without the presence of a credible SAM threat, aircraft participating in LINEBACKER II bombed with increased accuracy and little worry of being shot down. Figure 6 illustrates how systems thinking increased airpower’s effectiveness.

¹³⁸ Leonard D. G. Teixeira, “LINEBACKER II: A Strategic and Tactical Case Study,” [thesis, Air War College, Air University, Maxwell Air Force Base: Air University, 1990], 18.

¹³⁹ John Morocco, *Rain of Fire: Air War, 1969-1973*, [Boston: Boston Publishing Company, 1985], 157.

¹⁴⁰ Morocco, *Rain of Fire*, 157. This also illustrates North Vietnam’s lack of strategic depth.

¹⁴¹ Stanley J. Dougherty, “Defense Suppression: Building Some Operational Concepts,” [master’s thesis, School of Advanced Air and Space Studies, Air University, Maxwell Air Force Base: Air University Press, 1992], 13.

¹⁴² Tilford, *Setup: What The Air Force Did in Vietnam and Why*, 262.

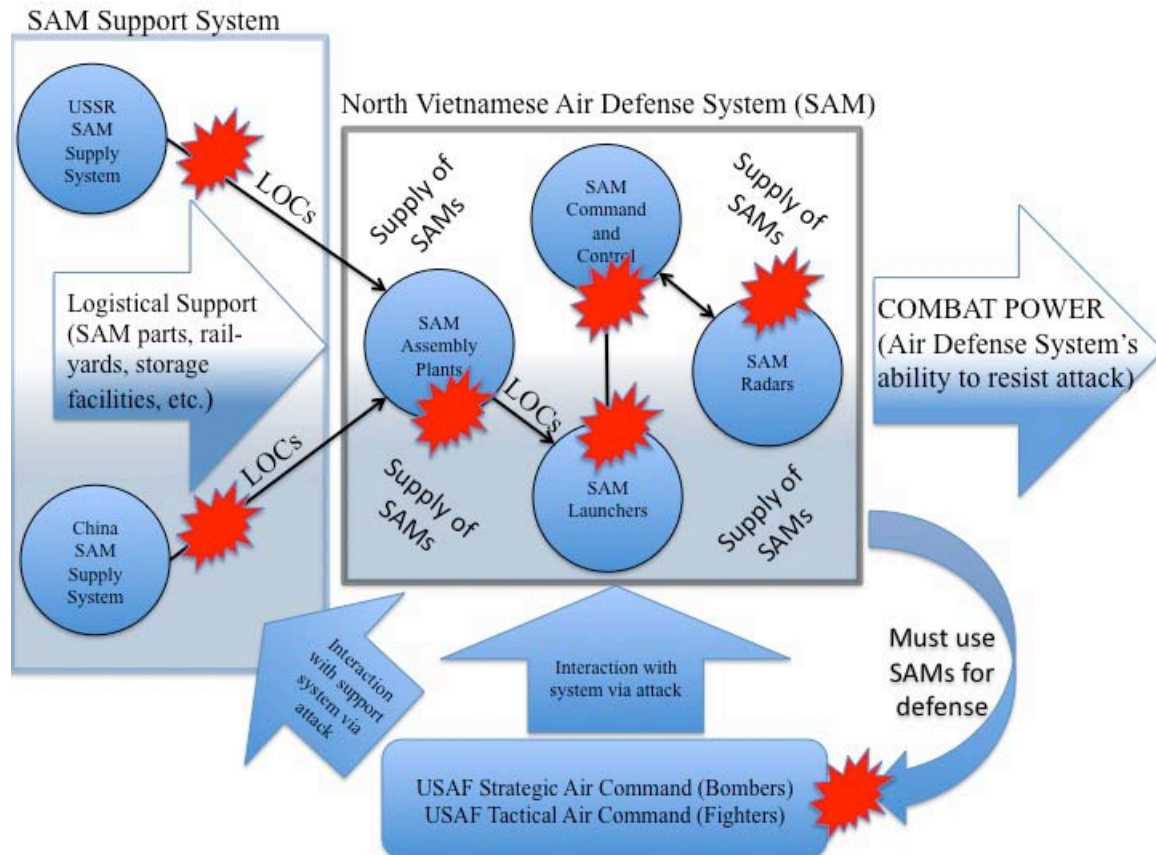


Figure 6. Impact of SAC Interdiction Against SAM and SAM Support System

The design fundamental of reflective thinking was evident in the planning and execution of LINEBACKER II. Once it became apparent to the Commander of SAC that negotiations were stalled, he began discourse with President Nixon and the Chairman of the JCS, Admiral Thomas Moorer. What emerged was the requirement for a major air campaign against North Vietnam. In response to this, General Meyer ordered "Eighth Air Force planners to prepare an operations plan."¹⁴³ The initial plan presented to Meyer conducted "extensive attacks against Hanoi and Haiphong using multiple-bomber formations simultaneously attacking from different directions."¹⁴⁴ This first plan was deemed too complicated and further discourse with President

¹⁴³ Head, *War From Above the Clouds*, 76.

¹⁴⁴ Ibid.

Nixon indicated the need for a new plan. This reflective thinking resulted from the president's concern that the original plan's potential for collateral damage "might be a major propaganda setback."¹⁴⁵

Discontent over SAC's new plan was evident in the response of both aircrew and lower echelon planners. Both "bomber aircrew and TACAIR folks all questioned the strike tactics."¹⁴⁶ The decision to move to a new plan did not occur without significant reflection-on-action. First, the shift to predictable routing stemmed from the realization that the complicated nature of the original plan might cause a significant degradation in accuracy, increasing the chance of collateral damage. For almost six years, B-52 crews conducted mainly Arc Light¹⁴⁷ operations and SAC "sought to preserve as much as possible of the routine quality of the missions the crews were accustomed to flying in South Vietnam."¹⁴⁸ When B-52s bombed North Vietnam as part of Operation LINEBACKER I, they were employed in a fashion similar to Arc Light. As a result, "planners designed the campaign based on the five B-52 raids over the North in April that had produced no losses."¹⁴⁹ It was also thought that employing the bombers at night would help mitigate the threat of North Vietnam's air defense system.

The results of the first two nights seemed to vindicate SAC's original air campaign. The "three B-52s lost on the first night, given 121 sorties were flown, represented an acceptable loss rate."¹⁵⁰ Furthermore, "on the second night . . . no aircraft were lost despite the fact that the North

¹⁴⁵ Head, *War From Above the Clouds*, 78.

¹⁴⁶ Teixeira, "LINEBACKER II: A Strategic and Tactical Case Study," 9.

¹⁴⁷ Arc Light operations were conventional bombing attacks by B-52s against communist forces in both Vietnams, Cambodia, and Laos. Arc Light operations began on 18 June 1965 and lasted the entire Vietnam War. Eschmann defines Arc Light operations as "conventional bombing of selected targets in Southeast Asia by SAC B-52s, exclusive of those targets associated with LINEBACKER II."

¹⁴⁸ Thompson, *To Hanoi and Back*, 264.

¹⁴⁹ Clodfelter, *The Limits of Air Power*, 192.

¹⁵⁰ Tilford, *Setup: What The Air Force Did in Vietnam and Why*, 255.

Vietnamese defender fired 200 SAMs.”¹⁵¹ As the hellish third night unfolded, SAC planners immediately recognized through reflection-in-action that significant changes to the plan were needed. During the second of three waves on the third night, “it was becoming obvious to the SAC battle staff that the B-52G models did not possess sufficient ECM power to successfully counter the SAM radar-guidance systems.”¹⁵² The “losses, damage, and near-misses had revealed a pattern [that] . . . the unmodified Gs were neither protecting themselves nor their formation adequately, and were bearing the brunt of losses.”¹⁵³ Reflective thinking on the first phase of Operation LINEBACKER II led planners to re-evaluate their previous assumptions and put more emphasis on adopting the ideas of lower echelons.

To address the problem of ECM weakness amongst certain models of bombers, planners shifted the B-52G back to “flying the Arc Light operations over South Vietnam”¹⁵⁴ while only the older B-52D with upgraded ECM would attack targets around Hanoi and Haiphong. To reduce predictability, planners shifted to approaching targets from multiple directions while compressing the bomber formations to reduce overall time over target. Bombers would fly “at varying altitudes and the immediate turns after bomb release were eliminated in favor of longer, more shallow turns which did not make for the kind of bright radar returns a B-52 can give off in a 45-degree bank.”¹⁵⁵ Crews were also allowed more freedom to maneuver between altitude blocks and exit the target area quicker “to further complicate the job of SAM operators.”¹⁵⁶ The result of the reflective thinking done by SAC’s planners is evident in the results of the fourth and fifth nights of bombing. Between “the innovative attack plan, the ECM support provided by the EB-66 and

¹⁵¹ Ibid.

¹⁵² Eschmann, *Linebacker: The Untold Story of the Air Raids Over North Vietnam*, 131.

¹⁵³ McCarthy and Allison, *LINEBACKER II: A View From the Rock*, 86.

¹⁵⁴ Eschmann, *Linebacker: The Untold Story of the Air Raids Over North Vietnam*, 138.

¹⁵⁵ Tilford, *Setup: What The Air Force Did in Vietnam and Why*, 257.

¹⁵⁶ Ibid.

Navy EA-6B aircraft, and a better coverage of the chaff corridors, the North Vietnamese were not able to respond effectively.”¹⁵⁷ No B-52s “were downed nor did any receive even minor battle damage”¹⁵⁸ during these two nights. SAC’s planners continued to adapt and reflect on operations for the remainder of LINEBACKER II. By the eighth day of bombing (the beginning of phase three), “B-52 strikes incorporated many of the aircrews’ suggestions based on their firsthand knowledge of the mission. SAC headquarters delegated almost total control to the wing staffs to adopt their own concepts and tactics to best fit the specific mission requirements.”¹⁵⁹ The impact of this reflective thinking was that the “outcome of Day Eight was a tactical masterpiece, demonstrating how well the lessons of the previous raids had been learned.”¹⁶⁰ Continuous reflective thinking increased airpower’s effectiveness so much so that for the remainder of LINEBACKER II “wave after wave of bombers pounded targets with relative impunity. The bombing could have proceeded indefinitely with little likelihood of further losses.”¹⁶¹

Framing

The presence of environmental framing and the establishment of reframing criteria increased the effectiveness of airpower in LINEBACKER II. The presence of a mature environmental frame is evident in General Meyer and his planners’ understanding of political tensions and the tensions existing between the nuclear and conventional mission sets of the B-52. Understanding of these tensions ensured the correct actions were taken to achieve national objectives and ultimately increased the effectiveness of airpower. The use of reframing criteria

¹⁵⁷ Eschmann, *Linebacker: The Untold Story of the Air Raids Over North Vietnam*, 155.

¹⁵⁸ Ibid.

¹⁵⁹ Eschmann, *Linebacker: The Untold Story of the Air Raids Over North Vietnam*, 162.

¹⁶⁰ Eschmann, *Linebacker: The Untold Story of the Air Raids Over North Vietnam*, 177.

¹⁶¹ Paul Burbage, Eli Gateff, James Hoffman, Blaine Lotz, Addison Rawlins, Barry Swarts, Ron Walker, and Rudolph Zuberbuhler. “The Battle for the Skies Over North Vietnam,” in *Air War – Vietnam*, ed. Gordon Nelson and Norm Wood [Indianapolis: Arno Press Inc., 1978], 289.

and the ability to reframe when needed saved the operation from collapse and ensured the fulfillment of the President's desire to bring North Vietnam back to the negotiating table.

The creation of a mature environmental frame by SAC planners and General Meyer increased the effectiveness of airpower during LINEBACKER II. This is seen by the insight General Meyer and his planners had into existing environmental tensions. General Meyer possessed a holistic view of LINEBACKER II's operational environment as evidenced by his understanding of political tensions and the tension existing between the dual-role of the B-52. From a political aspect, Meyer understood that the president "was looking for an end to the war and honorable withdrawal from the country without abandoning the primary objective or giving the appearance of defeat."¹⁶² Nixon provided additional context to Meyer's understanding stating that he wanted LINEBACKER II structured to "inflict the utmost civilian discomfort in a psychological sense by showing he would not tolerate a long delay in peace negotiations."¹⁶³ Further discourse with Admiral Moorer also revealed to Meyer that the chairman wanted "the people of Hanoi to hear the bombs, but minimize the damage to the civilian populace."¹⁶⁴ Finally, others within the U.S. government hoped that the "bombing would persuade the South's President, Thieu, to accept an agreement."¹⁶⁵ General Meyer had the difficult task of balancing senior policy makers desires to use B-52's to psychologically unhinge the population, wreak maximum destruction on the north, reassure South Vietnam's president, and preserve the B-52s as part of America's nuclear triad. Both General Meyer and Admiral Moorer "had learned . . . to

¹⁶² Irvin Lon Cakerice, "An Examination of LINEBACKER II," [thesis, Air War College, Air University, Maxwell Air Force Base: Air University, 1994], 5. The primary objective, according to Cakerice, was Nixon's desire to maintain an independent and non-communist South Vietnam.

¹⁶³ Phillip S. Michael, "The Strategic Significance of LINEBACKER II: Political, Military, and Beyond," [thesis, U.S. Army War College Strategy Project, Carlisle Barracks: U.S. Army War College, 2003], 9.

¹⁶⁴ Cakerice, "An Examination of LINEBACKER II," 18.

¹⁶⁵ Michael, "The Strategic Significance of LINEBACKER II," 9.

expect both B-52 losses and Soviet gains in knowledge about the aircraft with its advanced radar jamming capabilities.”¹⁶⁶ This view of the operational environment is represented in figure 7.

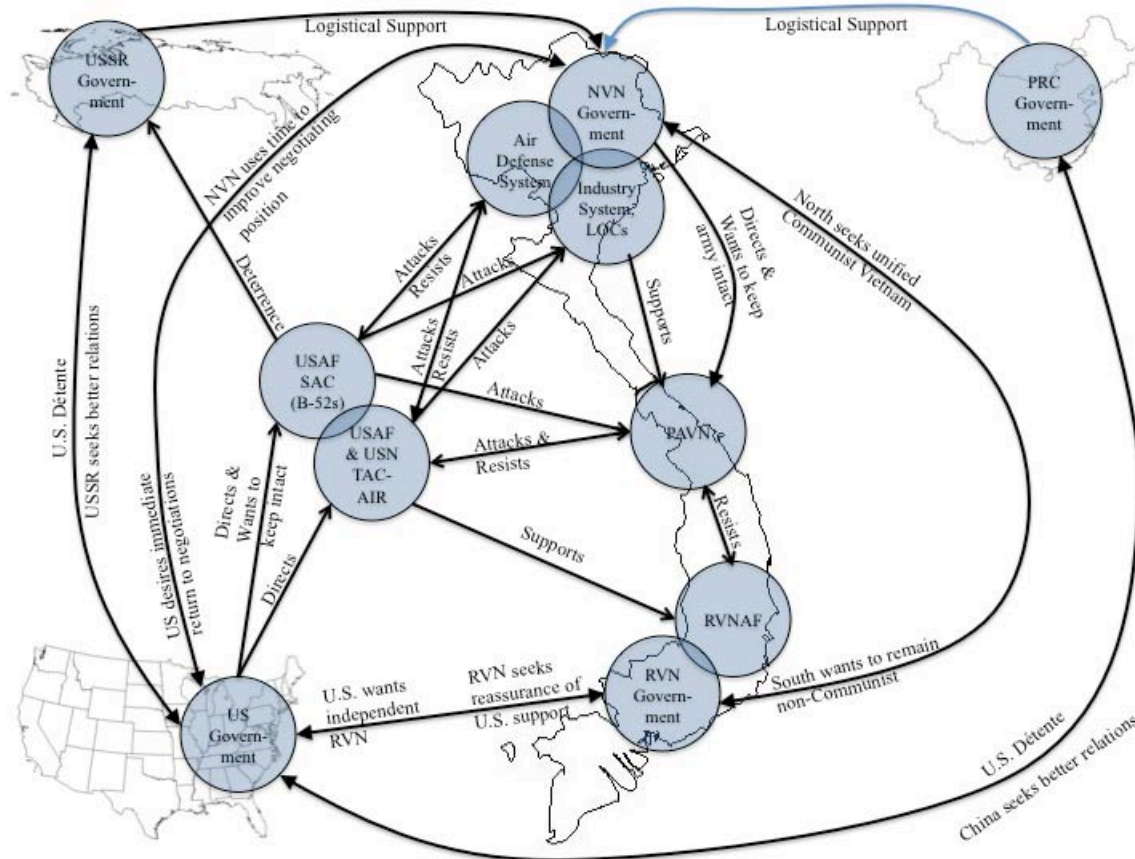


Figure 7. LINEBACKER II Operational Environment

Sources: Author, with map data from About.com: Geography, “Free Blank Outline Printable World Maps of the Countries and Continents of the World,” About.com, <http://geography.about.com/library/blank/blxindex.htm#u> [accessed January 28, 2010].

Another example of a mature environmental frame is seen in the understanding of the tension between balancing which aircraft could best achieve the president’s intent against the physical environment in which they would operate. December was a rainy month in North Vietnam and in order to maintain constant pressure on Hanoi, planners required an all weather attack capability. The only aircraft that could provide this capability were the A-6, F-111, and the B-52. However, too “few F-111s and A-6s were available to produce the offensive’s desired

¹⁶⁶ Thompson, *To Hanoi and Back*, 259.

shock,”¹⁶⁷ so the B-52 became the centerpiece of night operations. Meyer and his planners understood that if using the B-52s as a major component of LINEBACKER II was wrong, “then United States would lose a significant part of its long-range bomber fleet. Along with that loss would be an incalculable loss in credibility and military stature.”¹⁶⁸

Additional evidence that Meyer and his planners understood the tensions resulting from a mature environmental frame occurred in the midst of the third night of LINEBACKER II. As bombers were being destroyed, Meyer called his planning staff together and reviewed all aspects of the operation. Everything “was being evaluated on a real-time basis”¹⁶⁹ as to whether or not the remaining waves of bombers should continue to their objectives. When General Meyer ordered the bombers to “press on,” he did “not give blanket approval to a mindless continuation of things as they had been.”¹⁷⁰ The decision to continue was made because General Meyer and his subordinates possessed a keen understanding of tensions that only a mature environmental frame could provide. They understood competing needs of using B-52s to achieve the president’s strategic goals with the risk to the country’s nuclear capability. They also understood the tension between using the bombers to achieve the desired psychological impact on the population versus other aircraft due to weather and ordinance load. The presence of a mature environmental frame allowed General Meyer and his planners to accurately assess the risk involved with continuing the mission and the consequences of failing to complete the night’s objectives.

The type of targets selected by planners also illustrates the presence of a mature environmental frame. During the second phase of LINEBACKER II, planners wanted to destroy

¹⁶⁷ Eschmann, *Linebacker: The Untold Story of the Air Raids Over North Vietnam*, 75.

¹⁶⁸ McCarthy and Allison, *LINEBACKER II: A View From the Rock*, 1.

¹⁶⁹ McCarthy and Allison, *LINEBACKER II: A View From the Rock*, 86.

¹⁷⁰ Ibid. This is an example of both systems thinking and the interconnectedness of design’s foundations and framing activities. Jamshid Gharajedaghi notes on page 315 that systems thinking “is about seeing through chaos, managing interdependency, and understanding choice.” These aspects all presented themselves in General Meyer

the “Lang Dang rail yards, only eighteen miles from the Chinese border, and three nearby SAM sites.”¹⁷¹ This was possible because they understood the tension that existed between the United States, China, and the Soviet Union.¹⁷² Détente ensured that such actions would be tolerated provided they were not perceived as indiscriminate. The success of the attacks against these two targets and the lack of either a Chinese or Russian response confirm this point. Planners also understood how détente related to the approximately 100,000 North Vietnamese troops in the south and the value of this force as a mechanism in unifying the country. The “survival of the Northern Army was essential if Hanoi was to maintain control over Southern territory.”¹⁷³ By destroying targets that paralyzed the army, planners demonstrated understanding of tension between northern objectives and how détente related to them. “Détente prevented the North from receiving increased Soviet assistance . . . Bombing continued unabated against Northern troops in the South after Linebacker I ended and Linebacker II destroyed many of the supplies stockpiled above the 20th parallel.”¹⁷⁴ By understanding the relationship between détente and northern objectives, the United States leveraged airpower effectively against the North Vietnamese military. The results of the planners understanding of the tensions were best summed up by General Tran Van Tra, the commander of northern forces in South Vietnam. He said, “our cadres and men were fatigued, we had not had time to make up for our losses, all units were in disarray, there was a lack of manpower and there were shortages of food and ammunition . . . the troops were no longer capable of fighting.”¹⁷⁵

¹⁷¹ Eschmann, *Linebacker: The Untold Story of the Air Raids Over North Vietnam*, 156.

¹⁷² Détente emerged, as Clodfelter states on page 150 of his book, because “the Chinese required American support to end the isolation aggravated by their Cultural Revolution. Meanwhile, the Soviets desired an agreement on strategic nuclear weapons, and they desperately needed American grain.”

¹⁷³ Clodfelter, *The Limits of Air Power*, 196.

¹⁷⁴ Ibid.

¹⁷⁵ Ibid.

Another aspect of the U.S. Army's operational design methodology that increased the effectiveness of airpower during LINEBACKER II was reframing. Reframing was seen in SAC's recognition of the need to change the conduct of operations in response to adaptations by the North Vietnamese and the loss of bombers. During the development of LINEBACKER II, General Meyer determined one of the key measures of effectiveness would be the attrition of the bomber fleet. Planners "estimated acceptable B-52 losses would be 3%,"¹⁷⁶ which established something resembling reframing criteria. Another aspect of reframing criteria was exhibited in the planned duration of the operation. Planners developed both a three – day and six – day plan. If operations extended beyond either of these options, the original air campaign would require additional development. The air campaign would be successful so long as bomber attrition stayed below 3% and targets around Hanoi and Haiphong were under constant pressure for the planned duration of operations.

Night three triggered reframing in part due to the tremendous loss rate of B-52s. The bombers destroyed equaled a "6-percent loss rate"¹⁷⁷ which clearly exceeded the planning factor. Reactions to the destruction like "'stop the carnage – we can't lose any more B-52s – it has become a blood bath' were commonplace."¹⁷⁸ Another aspect that dictated a need to reframe involved the ability of the campaign to fulfill the president's objectives. When Nixon received word of the destroyed B-52s, he "railed at senior officials that such losses would cause LINEBACKER II to have the opposite effect of that which he desired."¹⁷⁹ To ensure the North Vietnamese did not think they had shaken America's resolve to continue the bombing, Nixon extended the campaign indefinitely. Extending the offensive contributed to the need to reframe

¹⁷⁶ Cakerice, "An Examination of LINEBACKER II," 13.

¹⁷⁷ Tilford, *Setup: What The Air Force Did in Vietnam and Why*, 256.

¹⁷⁸ McCarthy and Allison, *LINEBACKER II: A View From the Rock*, 85.

¹⁷⁹ Head, *War From Above the Clouds*, 80.

because initial planning covered only two options, a three – day or six – day campaign plan. As Karl Eschmann wrote, “one thing was known for sure by almost everyone who participated in LINEBACKER II: the SAC planners would have to develop a new battle plan if the B-52s were to continue their nightly attacks into the Hanoi area.”¹⁸⁰

SAC’s reframing involved analysis of how the bombers were employed, what target sets they attacked, and whether the objective of coercing North Vietnam back to the negotiating table was still valid. With regard to the last issue, Nixon’s indefinite extension of the air campaign answered this question. While planners evaluated which targets best suited an indefinite air campaign, a simultaneous review of bomber employment was occurring. Colonel Brown, the 307th Strategic Wing Vice Commander, was directed to “chair a special tactics panel to review the situation and make recommendations.”¹⁸¹ This panel developed several changes in response to the tactical adaption of the North Vietnamese. These changes on how the bombers employed were discussed in the section on reflective thinking and will not be repeated here. What is important to take away is that “when the 11 days of LINEBACKER II are viewed as a whole, one notable achievement of the campaign was the rapid change of complex tactics”¹⁸² which allowed U.S. to mitigate the air defense threat. By reframing how the bombers were employed, the effectiveness of airpower increased.

Also important was how planners reframed the operational focus of the air campaign. The primary objective of LINEBACKER II was to “convince the North Vietnamese that a very early return to the negotiating table would be in their best interest.”¹⁸³ It was also designed “to halt the

¹⁸⁰ Eschmann, *Linebacker: The Untold Story of the Air Raids Over North Vietnam*, 135.

¹⁸¹ Burbage, Gateff, Hoffman, Lotz, Rawlins, Swarts, Walker and Zuberbuhler. “The Battle for the Skies Over North Vietnam,” 286.

¹⁸² McCarthy and Allison, *LINEBACKER II: A View From the Rock*, 172.

¹⁸³ Burbage, Gateff, Hoffman, Lotz, Rawlins, Swarts, Walker and Zuberbuhler. “The Battle for the Skies Over North Vietnam,” 278.

massive communist resupply effort that gave Hanoi the capability to stage large scale offensive operations in SVN.”¹⁸⁴ As a result, targets that exerted the largest impact on both were selected for destruction first, with air defense sites and associated support facilities often taking a secondary or tertiary role. In response to the indefinite extension of bombing and the toll SAMs had taken on the bomber fleet, “planners and staff officers . . . came up with the next phase of Linebacker Two: an all out attack on the North Vietnamese air defenses.”¹⁸⁵ This new plan encouraged “directly attacking those defenses and not just reacting to them with Wild Weasels and hunter-killer teams.”¹⁸⁶ The “shift to attacking the enemy’s air defense had both tactical and strategic objectives.”¹⁸⁷ Tactically, destroying the air defense systems would “preclude further losses of B-52s.”¹⁸⁸ This is important because “had B-52 losses continued to mount, it might have been necessary to abdicate the campaign to North Vietnam’s defenses.”¹⁸⁹ By targeting the ability of North Vietnam to defend itself, it “would be totally at the mercy of the United States, thus making a strategic victory possible.”¹⁹⁰ Although the systems thinking that enabled this feat was discussed previously, the recognition of the need to reframe and the subsequent shift of operational focus increased airpower’s effectiveness and “would significantly alter the outcome of LINEBACKER II.”¹⁹¹

¹⁸⁴ Burbage, Gateff, Hoffman, Lotz, Rawlins, Swarts, Walker and Zuberbuhler. “The Battle for the Skies Over North Vietnam,” 278.

¹⁸⁵ Tilford, *Setup: What The Air Force Did in Vietnam and Why*, 257.

¹⁸⁶ Thompson, *To Hanoi and Back*, 267.

¹⁸⁷ Tilford, *Setup: What The Air Force Did in Vietnam and Why*, 259.

¹⁸⁸ Ibid.

¹⁸⁹ Ibid.

¹⁹⁰ Ibid.

¹⁹¹ Eschmann, *Linebacker: The Untold Story of the Air Raids Over North Vietnam*, 150.

Conclusions and Recommendations

Conclusion

Army Field Manual 5-0 states “conflict is invariably complex because it is fundamentally human in character.”¹⁹² The U.S. Army’s Operational Design methodology is a tool well suited to managing complexity and shows great promise for increasing the effectiveness of airpower in warfare. Using a core of systems thinking, reflective thinking, discourse and iteration, these design foundations enable the framing activities that provide context and synthesis during the genesis of a solution, ultimately resulting in a common shared understanding of a problem. The result of using this methodology is an increase in operational effectiveness evidenced by an improved ability to adapt, “fewer unintended consequences, economy of effort, [and] better integration . . . among the instruments of national power.”¹⁹³ Applying the U.S. Army’s Operational Design methodology to two historical case studies demonstrate how it increases airpower’s effectiveness.

Operation CASTOR and the subsequent battle for Dien Bien Phu illustrate how, if the French Air Force had applied design-like elements, they would have increased airpower’s effectiveness and avoided the ensuing disaster. Without design, the French Air Force supported a plan so flawed that its failure ultimately caused the withdrawal of the French from Indochina. The absence of systems thinking was shown in how French Air Force planners did not understand the nature of their technology driven logistical system and how it compared to the human driven logistical system of the Viet Minh. First, French planners did not understand that for air interdiction to be effective, they needed to simultaneously attack the Viet Minh Logistical system while exerting pressure on the Army system. As a result, the Viet Minh used time and a complex

¹⁹² Headquarters Department of the Army, Field Manual 5-0: *The Operations Process*, 3-3.

¹⁹³ Ibid.

logistical apparatus to heal and adapt their logistical system, enabling them to generate overwhelming combat power whenever they wanted. Systems thinking was also absent in the analysis of the friendly logistical system. As operations continued against a numerically superior foe, it was apparent that the French needed more men and material. This increase in men and material placed additional demand on an overburdened air transport fleet. As more soldiers entered the battle, more supplies were required. The cycle continued to the point where it became untenable and the French lost combat power. The French's technology based logistical system was overstressed and airpower became ineffective at meeting the demands of the garrison.

The lack of reflective thinking ensured that planners did not challenge the fundamental assumption of Operation CASTOR. Based off the success at Na-San, planners did not analyze why the air-land base concept worked so well and if it would function in the same fashion at Dien Bien Phu. Planners never inquired as to what was different between the two cases and no one challenged the basic validity of the air-land base concept. The result was that the French Air Force supported a plan with significant operational deficiencies that limited from the outset how effective airpower could be in the battle for Dien Bien Phu. The lack of action by higher commanders over the tactical concerns of the Air Force highlights an interesting point about design. If the French Air Force used the U.S. Army's design methodology, would they have better articulated their concerns in a manner that tied tactical issues to operational level impacts?

Failure to conduct environmental framing caused French planners to underestimate the enemy and miss important cultural and political tensions. French Air Force planners subscribed to the view that the Viet Minh were a peasant army and incapable of mounting significant resistance to Operation CASTOR and French airpower. By not exploring this tension further, planners missed the fact that the Viet Minh had a unique characteristic of "ant logistics" which enabled the Army to supply itself under extraordinary circumstances. Failure to explore the political tension between the French government's objectives for Indochina and the objectives of Operation CASTOR ensured that any objections to CASTOR would remain tactical. There was never any

analysis of how airpower linked to accomplishing political objectives. Had this tension been explored, planners might have come to the revelation that the French government had no desire to defend Laos, only to achieve the best military position for negotiations to end the war. If the air planners were aware of this tension, it was not recorded because no one questioned the use of airpower on the grounds it did not further the accomplishment of political objectives.

Lastly, the French failure to reframe prevented timely adaptation and reduced the effectiveness of airpower. Planners did not reevaluate Operation CASTOR in light of the tactical concerns of the French Air Force. The continued presence of large caliber AAA around Dien Bien Phu never prompted a reframe of the plan even though one of the assumptions was that the French Army could mitigate this threat to airlift aircraft. Another instance of the failure to reframe occurred at the loss of Lai Chau. When this defensive point was lost, it was impossible for the French to ensure the unrestricted use of the garrison's airfield. Use of the airfield was critical for the resupply and the ability of the French Army to generate combat power. Once Lai Chau fell, there was no reframe of the plan. French Forces continued to struggle in vain against the Viet Minh, ultimately sealing their fate and that of the French in Indochina.

In contrast to CASTOR, Operation LINEBACKER II demonstrates how the presence of design-like elements increased the effectiveness of airpower. The use of systems thinking created an effective interdiction plan against North Vietnam's air defense system. By attacking the SAM support system through interdiction of rail LOCs and SAM assembly plants, SAC planners reduced the amount of material moving to SAM sites. The high tempo of operations and the deliberate targeting of the SAM system in phases two and three caused the air defense system to react defensively by expending large amounts missiles. Reducing the flow of supplies and increasing the rate of usage caused North Vietnam to run out of SAMs, allowing participating aircraft to roam the country at will. Airpower was more effective because U.S. aircraft could now bomb more accurately. The reduced SAM threat also decreased the loss of friendly forces, ultimately allowing the U.S. to continue the destruction of North Vietnam uncontested.

The presence of reflective thinking ensured the rationale behind the air campaign was sound. Reflective thinking led to the questioning of key assumptions in the original plan and when some of the assumptions appeared to be faulty, reflective thinking caused significant changes to bomber employment. In the wake of North Vietnam's adaptation to the air campaign, SAC planners reflected on the recommendations made by lower echelon commanders and crewmembers and adapted bomber employment in response. The new methods of employment significantly reduced the loss of aircraft, which increased the effectiveness of airpower.

These two design fundamentals positively affected the progression of framing activities during Operation LINEBACKER II. The development of a mature environmental frame allowed planners to exploit a variety of tensions within the operational environment. The commander of SAC and his planners were able to use détente to their advantage when attacking key components of the SAM system close to the Chinese border. They understood the tension between the president's desires to ensure a non-communist South Vietnam, the desire to leave Vietnam with honor, and to bring North Vietnam back to the negotiating table all before Congress could stop funding for U.S. military operations. This is evident by the risk SAC took using B-52s to psychologically compel the enemy and cause maximum physical damage to North Vietnam's industry and infrastructure despite the aircraft being vital to the nuclear triad. They also kept pressure on North Vietnam's army in the south, as planners understood the value of the army as a mechanism to accomplish northern goals of unification. Exploiting this tension put additional pressure on North Vietnam to return to negotiations quickly otherwise nothing would remain of their army. Airpower's effectiveness was increased because the mature environmental frame developed by General Meyer and SAC planners allowed them to exploit key tensions.

Finally, the use of reframing criteria and the willingness to reframe the focus of the air campaign after the third night was a significant accomplishment that increased airpower's effectiveness. SAC planners knew two factors would cause a significant change in the conduct of operations. The first was duration of the campaign and the second was a loss rate greater than 3%.

Both of these criteria were exceeded on the third night. Reframing shifted the priority of operational objectives and though industry and infrastructure remained important, the dismantling of North Vietnam's air defense system became the top priority for the later phases of the air campaign. Shifting focus to the air defense system removed this danger to friendly aircraft who could destroy at will virtually any target in North Vietnam.

The reframing aspect of LINEBACKER II demonstrates how all aspects of the U.S. Army's operational design concept are related. The development of a complete environmental frame meant planners understood what tensions had the greatest potential for manipulation. This holistic perspective informed the systems thinking SAC planners used to dismantle North Vietnam's air defenses. Reflective thinking made possible the changes necessitated by a reframed approach to operations in the wake of night three. All of these combined ensured the accomplishment of political objectives as evidenced by North Vietnam's return to the negotiating table only 11 days after bombing commenced.

Recommendations

This monograph demonstrated how, through historical case study analysis, that elements of the U.S. Army's Operational Design methodology can increase the effectiveness of airpower. It is one small step towards illustrating how design can augment existing Air Force theory and doctrine. The next step is for the USAF to initiate discourse with other services to determine the best application of design to airpower in both Major Combat Operations and Irregular Warfare. U.S. Joint Forces Command issued a memorandum highlighting the need for all services to enter the debate on design. General James Mattis wrote "the other Services as well as the joint community are beginning to appreciate that the Army has achieved positive results with its initiative, and I believe the Army has demonstrated the value of this new approach to operational

design.”¹⁹⁴ Lastly, future research should examine additional case studies in order to validate the claims made in this monograph as to the positive impact of design on airpower in warfare.

¹⁹⁴ Mattis, Memorandum for U.S. Joint Forces Command, 1.

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